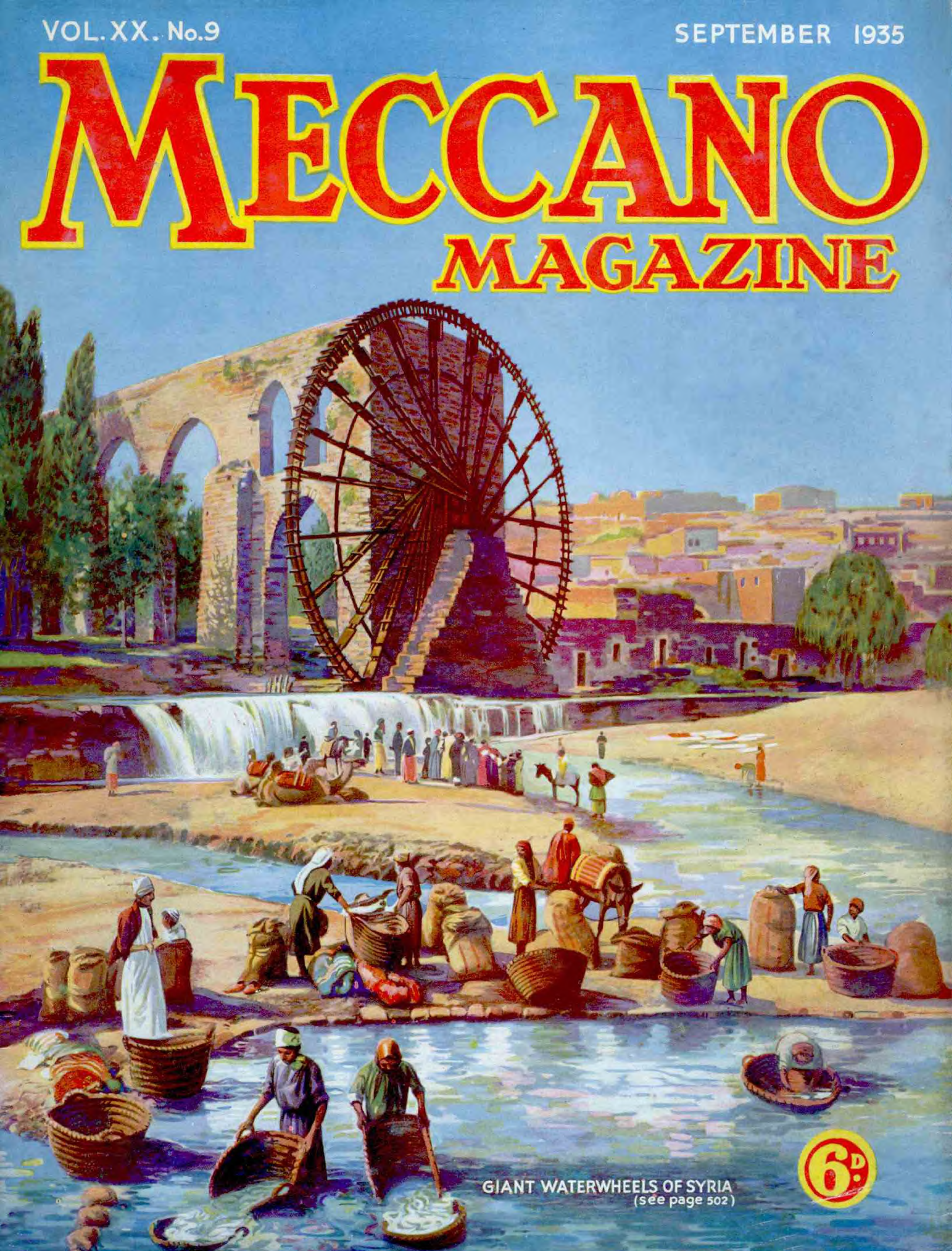
VOL. XX. No. 9 SEPTEMBER 1935

MECCANO MAGAZINE



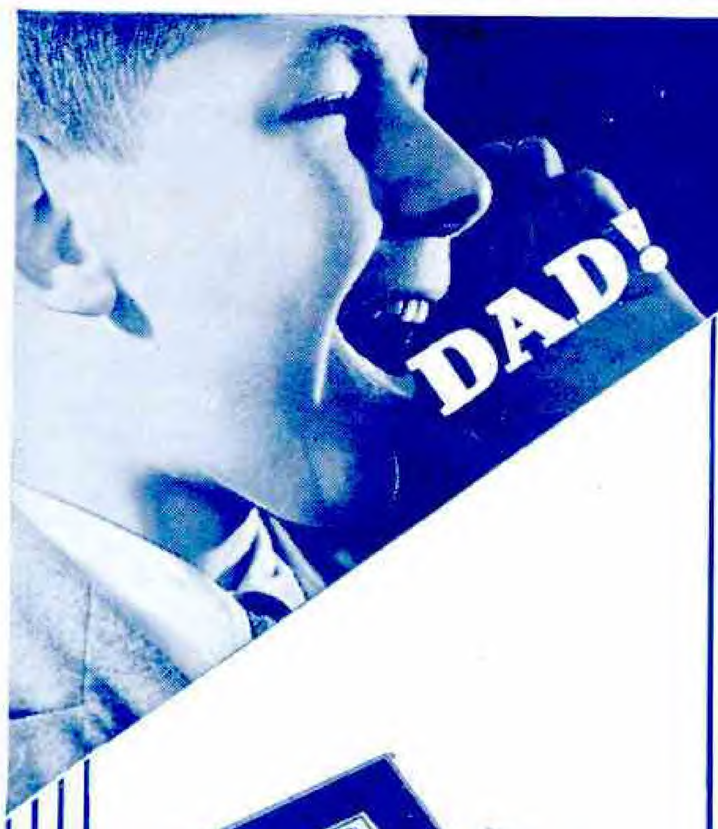
GIANT WATERWHEELS OF SYRIA
(see page 502)

6D.

THE MECCANO MAGAZINE

MECCANO

ENGINEERING FOR BOYS



I'M BUILDING A CRANE NEXT!

Every boy is happiest when he is inventing, creating and building. That is the reason for the everlasting popularity of Meccano. It is the most wonderful and the most fascinating hobby in the world, because it enables full scope to be given to all the inclinations and desires that are the natural heritage of boys.

The Meccano system is composed of approximately 300 different parts, each of which serves a definite mechanical purpose. These perfectly finished parts combine to form a complete miniature engineering system with which practically any mechanical movement can be reproduced in model form. More can be accomplished with Meccano than with any other constructional toy, for no other system has such possibilities. The genius is in the parts, and the youngest boy can begin to build Models as soon as he gets his Outfit home.

POWER UNITS

If you want to obtain the fullest enjoyment from the Meccano hobby you must operate your models by means of one of the Meccano power units. Meccano Clockwork Motors are obtainable at prices ranging from 2/- to 9/- and Meccano Electric Motors from 9/- to 18/6.

THE MECCANO MAGIC MOTOR

This year we have introduced the Meccano *Magic* Motor, a marvellous clockwork mechanism for driving the smaller models.

This splendid Motor is capable of driving all the Meccano A and B Outfits models, and many of the lighter models illustrated in the Manuals for the C, D and E Outfits. It is non-reversing ... ... Price 2/-



The *Magic* Motor



B Meccano Outfit Price 7/6



D Meccano Outfit Price 15/-



H Meccano Outfit Price 72/6

PRICES OF MECCANO OUTFITS

COMPLETE OUTFITS

A	Outfit	each	5/-
B	.. ..	..	7/6
C	.. ..	..	10/-
D	.. ..	..	15/-
E	.. ..	..	20/-
F	.. ..	..	30/-
G	.. ..	..	55/-
H	.. (Carton)..	..	72/6
Hw	.. (Cabinet)	..	97/6
K	.. (Carton)... ...	..	132/6
Kw	.. (Cabinet)	..	157/6
L	.. (..)	..	400/-

ACCESSORY OUTFITS

The purpose of Meccano Accessory Outfits is to connect the main Outfits from A to L. They are best described as the stepping stones to bigger and better models. Thus a B Outfit can be converted into a C by adding to it a Ba Accessory Outfit, and a Ca would then convert it into a D. No matter how small the Outfit you commence with, you may build it up by degrees until you possess all the parts contained in the largest Outfit.

Aa	converts	A	Outfit	into	B	... each	2/6
Ba	..	B	..	..	C	... ..	3/-
Ca	..	C	..	..	D	... ..	5/6
Da	..	D	..	..	E	... ..	5/6
Ea	..	E	..	..	F	... ..	11/-
Fa	..	F	..	..	G	... ..	26/6
Ga	..	G	..	..	H	... ..	17/6
Ha	..	H	..	..	K	... ..	60/-
Ka	..	K	..	..	L	... ..	225/-

MECCANO LTD.
BINNS ROAD
LIVERPOOL 13

This splendid model of an Automatic Grabbing Crane is built entirely of Meccano parts.

There is no limit to the number of models that can be built with Meccano—the world's best hobby for boys.



Hamleys News

· HAMLEY · BROTHERS · LTD · ESTABLISHED · 1760 ·

200-202, REGENT STREET, LONDON, W.1 **OUR ONLY ADDRESS**

Number Twenty-nine *September, 1935*

THE RIGHT START FOR THE NEW SEASON

Now that Autumn is here and a new games season is beginning, be sure that you give yourself a fair chance to do your best by having up-to-date equipment for your own particular games. Come along to our second floor and see all the latest designs or, if you live out of London, send us your order by post. We know you'll be satisfied.



FLOOR TO CEILING PUNCH BALL

Very easily fitted by means of a hook in the floor and one in the ceiling. Adjustable strong ball. Price **12′6** Postage 6d.



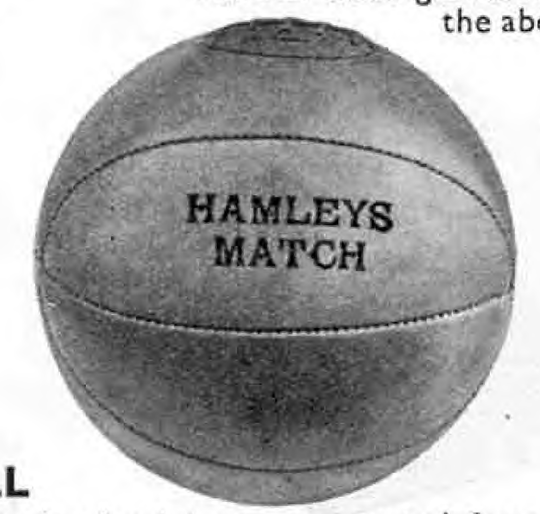
REGENT RUGBY BALL

A 4 panel ball made of selected hide. Very suitable for school use. Size 4, **10**/–. Size 5 ... **10′6** Complete with bladder. Postage 6d.



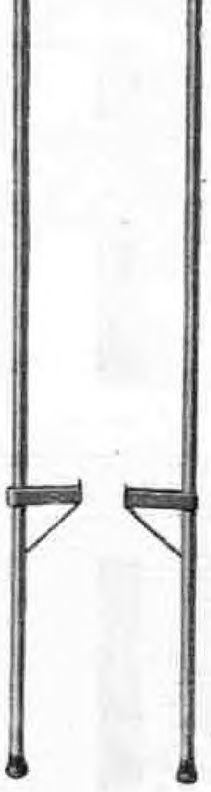
BOXING GLOVES

Made of fine quality tan cape, hair stuffed with bar palm. Boys' set of 4, **12/6.** Youths' set of 4, **13/6.** Men's set of 4 ... ... **16′6** Pairs of these gloves may be had at half the above prices. Postage 4d.



MATCH FOOTBALL

A strong 8 panel school ball, constructed from stout hide and well sewn. Size 2, **3/6.** Size 3, **3/11.** Size 4, **4/6.** Size 5 **5′-** Postage 6d.



STILTS

Great fun in Winter or Summer. "Be above the other fellow." Adjustable rests all metal. Price **7′6** Carriage 9d.



ROLLER SKATES

A special ball-bearing skate made by one of the leading American skate manufacturers. Self guiding and adjustable. Suitable for boys or girls. Price **10′-** Postage 6d.



SHEATH KNIFE

A most attractive knife fitted with compressed leather handle and Sheffield blade. Complete in leather sheath. Price **4′6** Postage 3d.

STAG CLASP KNIFE

A most useful boy's knife, fitted with ring to attach to belt, and best quality Sheffield steel blades, with several gadgets including screwdriver. Price **4′11** Postage 3d.

This is ideal Frog weather. Enjoy it by getting a Frog now instead of waiting until Christmas

'How I got my FROG'



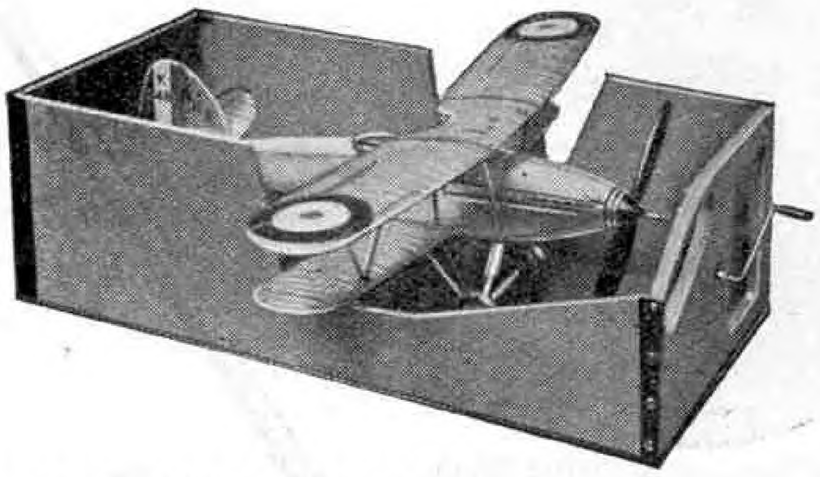


"Wish I had a FROG."

"Why don't you do what I did? I asked Dad if he didn't think I ought to know about flying. He said he'd get me a book about it, so I told him that what I wanted was a real scale model like they use in Flying Schools to teach future pilots. Then I told him they were only 5/- now and that they had a special winder-box that saves an awful lot of time. The next day he brought one home."

Frog Interceptor Fighter - Now Only 5/-

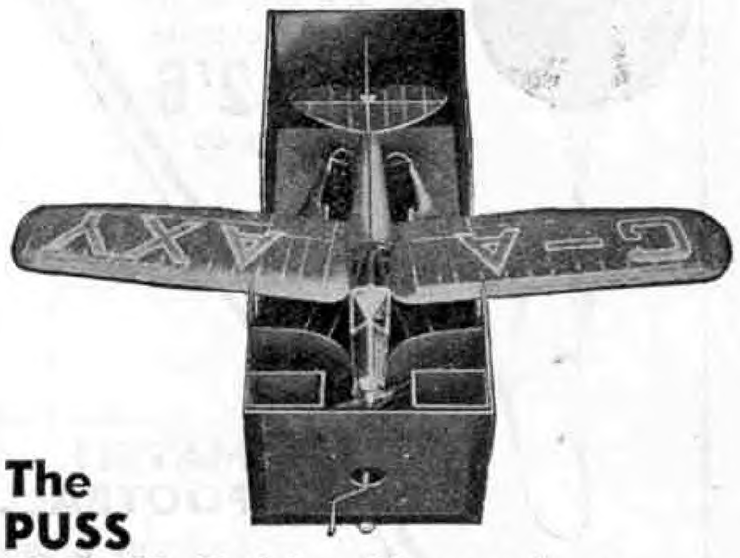
(see illustration on page iii)



HAWKER "HART"

Wing Span—19". Length 15½". An exact scale model of the world-famous R.A.F. High-Speed Day Bomber. Complete with extra strong **Patent High-Speed Winder-Box,** lubricant for gearbox and motors, triple insertor rod, spare motors and profusely illustrated flying manual. **Flies 700 feet** if handled skilfully.

42/-



The PUSS MOTH Cabin Monoplane

Wing Span—18½". Length—13½". Complete with **Patent High-Speed Winder-Box,** Spare Motors, Dual Insertor Rod, Motor Lubricant, Gearbox Oil and fully illustrated Instruction Manual. Flights of 600 ft. can be obtained under favourable conditions and heights of 50 ft. are readily obtainable with a little experience.

17/6

"Frog" Flying Club

Owners of "Frog" model aircraft are eligible for membership of the "Frog" Flying Club. The badges illustrated are obtainable by those members who pass proficiency tests. Price **6**d. each. Send Coupon for particulars.

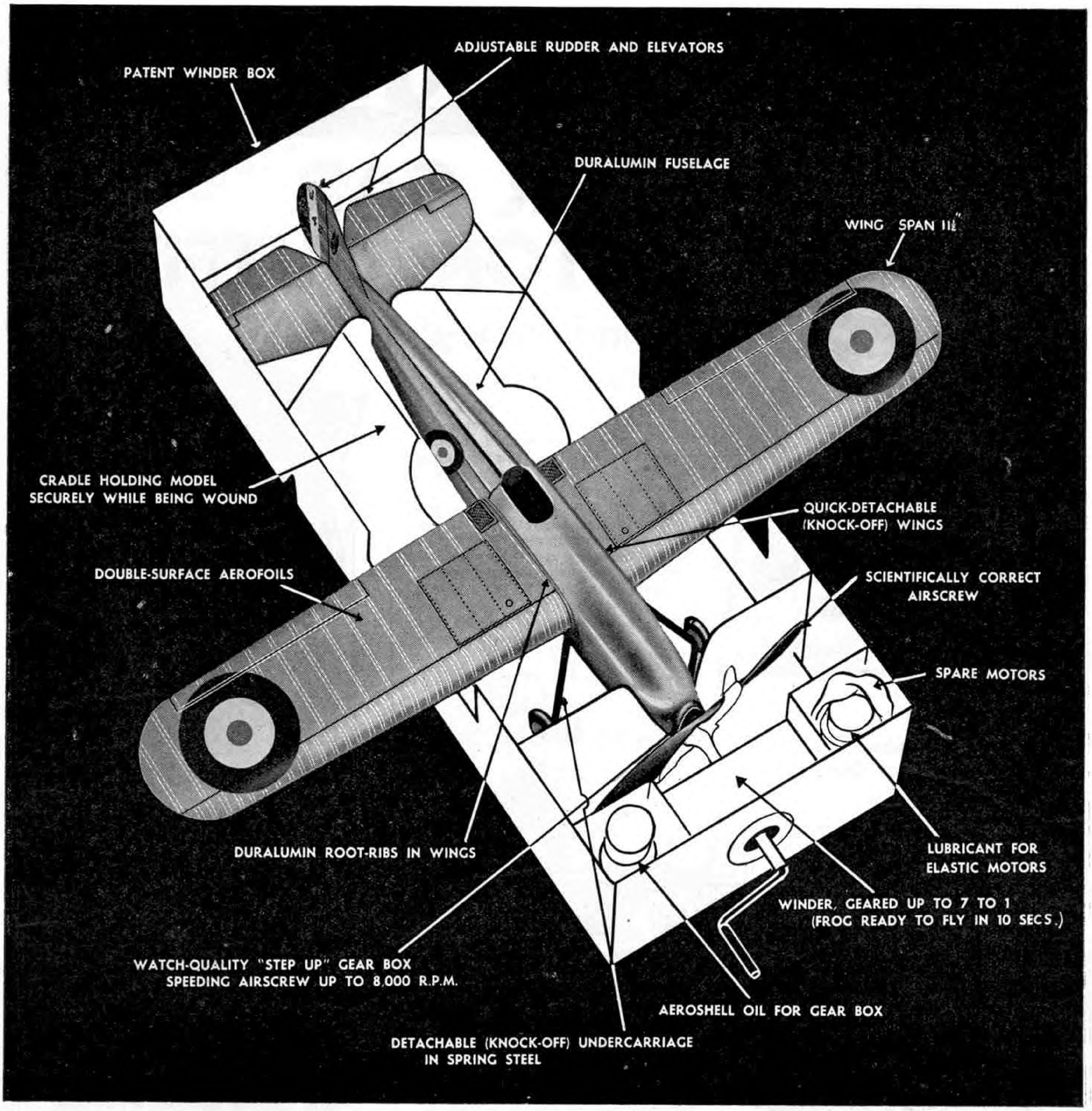
COUPON To Lines Bros. Ltd. (Dept. L), Morden Road, London, S.W.19.

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and of how to obtain handsome enamelled Air Force pilot badges.

NAME .....

ADDRESS.....

.....



"FROG" INTERCEPTOR FIGHTER

Correctly coloured with British Service markings and aluminium finish to Air Ministry specification. Also obtainable with the correct national markings of six other countries. Each model is flight tested before leaving the factory.

5/-

NOW ONLY

British made by INTERNATIONAL MODEL AIRCRAFT LTD.

Sole Concessionaires: **LINES BROS. LTD.**

Tri-ang Works, Morden Road, Merton, S.W.19

FREE COUPON

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and of how to obtain handsome enamelled Air Force pilot badges.

NAME.....

ADDRESS .....

L

ANOTHER OF MECCANO LTD'S FAMOUS TOYS

MOTOR CAR CONSTRUCTOR OUTFITS



No. 1 Meccano Motor Car Outfit

Good News!

Prices are Lower

Boys! Here is good news. The prices of No. 1 and No. 2 Motor Car Outfits have been reduced substantially this year, making this fascinating constructional hobby more attractive than ever.

Perfect miniature reproductions of many different types of car can be built with these splendid Motor Car Outfits, including sports four-seaters, speed cars, sports coupés and others.

Now is the time to get a Motor Car Outfit. You will never grow tired of building and running the superb models that you will be able to construct with it.





No. 2 Meccano Motor Car Outfit

No. 1 Motor Car Constructor Outfit

The motor car models that can be built with this Outfit are the finest you ever saw. Look at the examples illustrated below and think of the fun you could have building these and other types equally realistic.

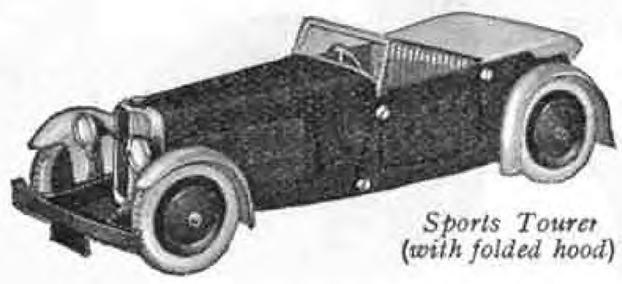
No. 1 Outfit is available in four different colour combinations and is supplied complete with powerful Clockwork Motor.

Reduced Price **10/-**

Note—Tbe parts in the No. 1 Motor Car Constructor Outfit cannot be used with those in the No. 2 Outfit.



Sports Tourer (with hood)

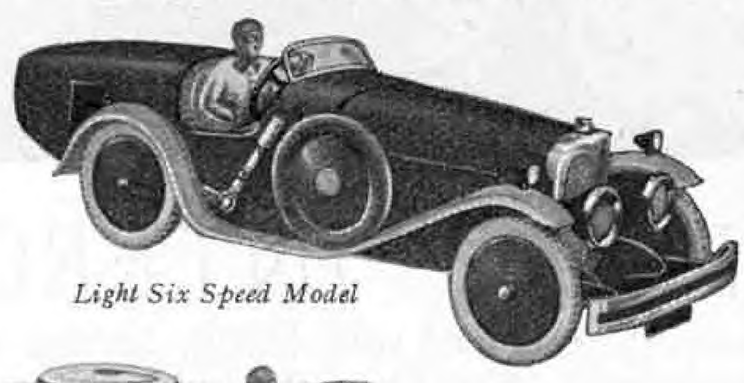


Sports Tourer (with folded hood)

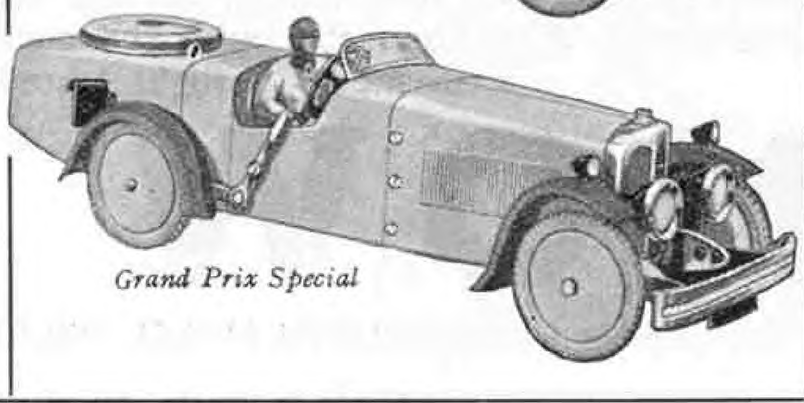
No. 2 Motor Car Constructor Outfit

Larger models of a superior type can be built with No. 2 Outfit. Their handsome and realistic appearance may be judged from the illustrations shown below.

No. 2 Outfit is available in four different colour combinations, and a powerful Clockwork Motor that gives a run of 150 feet on one winding is included. Reduced Price **20/-**



Light Six Speed Model



Grand Prix Special

Choice Range of Colours

If extra parts in any of the standard colours are required they can be purchased from any Meccano dealer. In addition to the four standard colour combinations, the following parts are available in the colours indicated:

Body Sections: orange, yellow. Wheels: orange, yellow. Wings: orange, green.

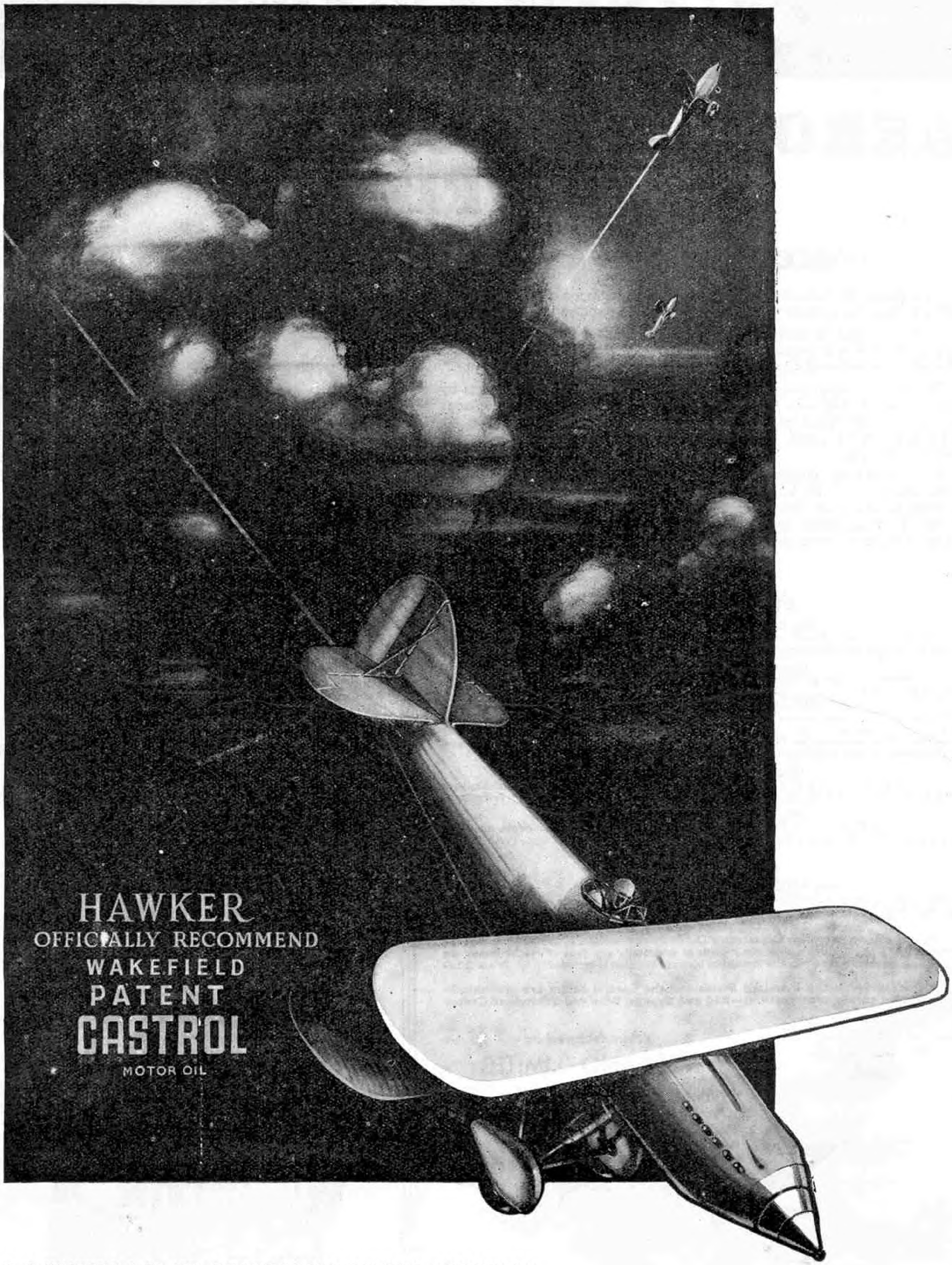
Motor Car Garage

This realistic Motor Car Garage provides accommodation for any Meccano model motor car or other cars of suitable size. Inside dimensions: Height 5 in., Length 13 in., Width 7¾ in. Price **5/6**

Motor Car Lighting Set

This Lighting Set enables the headlamps of Motor Car models built with the No. 2 Motor Car Outfit to be electrically lighted. Price **2/6**

MECCANO LIMITED BINNS ROAD LIVERPOOL 13



C. C. WAKEFIELD & CO. LTD., WAKEFIELD HOUSE, CHEAPSIDE, LONDON, E.C.2

ANOTHER OF **MECCANO LTD'S** FAMOUS TOYS

AEROPLANE CONSTRUCTOR OUTFITS

PRICES ARE LOWER

The prices of Aeroplane Outfits have been reduced this year, and it is certain that this wonderful hobby will be more popular than ever.

Every boy should know how aeroplanes are designed and constructed, and should be able to recognise at a glance the different types of machines in order to understand the purposes for which they have been developed.

These fine Constructor Outfits contain a range of aeroplane parts by means of which boys are able to design and build their own Aeroplanes quite easily, for these parts make possible aeroplane construction on sound engineering lines. They are all interchangeable on the famous Meccano principle.

The beautifully illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low-wing Monoplanes, Biplanes, Seaplanes and giant amphibian machines. In fact, models of almost every type of aircraft can be made with these splendid Outfits. Ask your dealer to show them to you.

PRICE LIST

STANDARD SERIES

No. OO AEROPLANE OUTFIT

This excellent new Outfit contains a good selection of Aeroplane Parts, with which realistic models of aeroplanes can be built. Price **3/3**

No. O AEROPLANE OUTFIT

An interesting range of models can be built with this Outfit, including high and low wing monoplanes. Price **4/6**

No. OIP AEROPLANE HANGAR OUTFIT

This novel Outfit consists of the complete range of No. O Aeroplane Outfit parts packed in a No. O1 Aeroplane Hangar. Price **8/9**

Note.—The parts in the No. OO, No. O and No. OIP Aeroplane Outfits are not intended for use with any of the other Outfits.

No. I AEROPLANE OUTFIT

Magnificent models of high and low wing monoplanes, and interesting model biplanes can be built with this fine Outfit. Price **7/6**

No. 2 AEROPLANE OUTFIT

The parts contained in this Outfit make possible a splendid range of models, including triple-engined monoplanes and biplanes and a racing seaplane. Price **12/6**

SPECIAL SERIES

No. I SPECIAL AEROPLANE OUTFIT

The parts in this Super Aeroplane Outfit will build over 20 realistic models of different types of aircraft. Price **12/6**

No. 2 SPECIAL AEROPLANE OUTFIT

This is the finest Aeroplane Constructor Outfit on the market. It contains a big range of aircraft parts, with which numerous models of practically any type of machine may be built—44 examples are shown in the Manual of Instructions that is included. Price **21/-**

All the Outfits in the Standard Series and the Special Series are available in three different colour combinations—Red and Cream, Blue and White and Cream and Green.



This fine model of a low-wing monoplane is made with No. 2 Special Aeroplane Outfit.

Manufactured by

MECCANO LIMITED

Binns Road - Liverpool 13



No. O Aeroplane Outfit. Price **4/6**



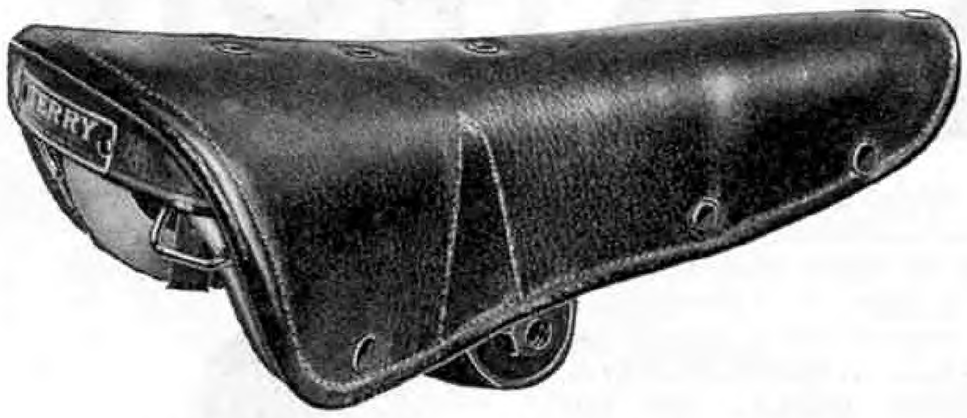
No. 1 Aeroplane Outfit. Price **7/6**



No. 2 Aeroplane Outfit. Price **12/6**

A NEW RACING SADDLE

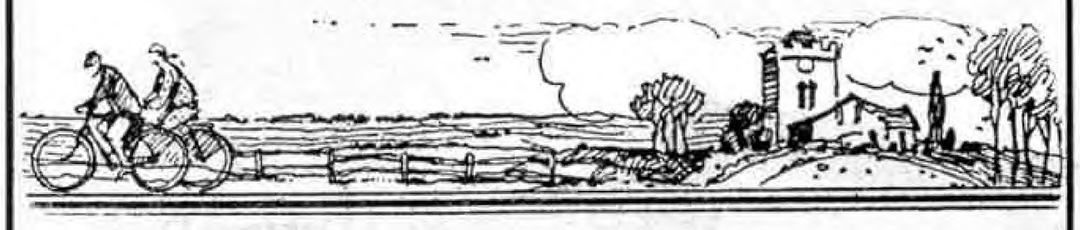
Narrow, Light and Comfortable



1 lb. 11 ozs. 5" at widest point.
A Perfect Hammock of Springs

See one at your Cycle Dealers

Only **12'6** each



HERBERT TERRY & SONS LTD., Redditch

Backed by the longest experience



The ANGLO-AMERICAN OIL CO. LTD.
have distributed highest-grade petroleum products in the British Isles since 1888

for lubrication use Essolube

1/6 ASTOUNDING VALUE! 1/6

SCALE FLYING MODEL KITS.

12" to 15" Wing Span—1/6 each, Post Free.

Guaranteed to Fly when completed. Everything necessary is included—Drawing, Printed-out Balsa, Cement, Paint, Tissue, Wheels, Elastic, etc.

PUSS MOTH	SOPWITH CAMEL	CURTIS GOSHAWK
S.E.5 SCOUT	FOKKER TRIPLANE	WACO "C"
FOKKER DVL11	BOEING P.12.E.	FAIRCHILD "24"
MONOCOUPE	POLISH FIGHTER	BOEING L.W.
SPARROW HAWK	STINSON RELIANT	BABY R.O.G.

Also:

FAIRCHILD "22" 16" Span **4/-** Post Free

MONOCOUPE, S.E.5., 20½" Span 16" Span **5'6** Post Free

Kits for SCALE AEROPLANES, GALLEONS and HISTORIC SHIPS —over 70 Types. 10d., 2/9 and 10/6 per set, Post Free.

THE MODEL SHOP, 3, College Road, Barras Bridge, Newcastle-upon-Tyne, 2.
Catalogue—2d. Post Free. *Agents wanted for the U.K.*



21'- Complete

NIGHT RIDERS

The dark evenings are almost with us. See that your cycle is equipped with a reliable Dynamo Lighting Set; one which gives brilliant light when riding slowly or quickly.

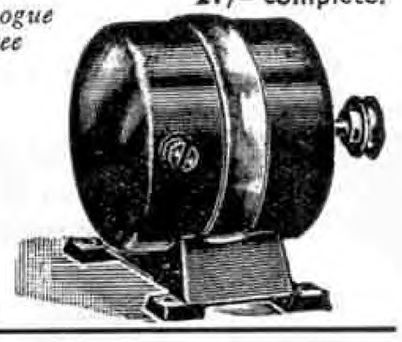
The famous "WILCO" DE LUXE Dynamo Set is all chromium-plated. Special Patent Silvered Reflector increases density of light. The 6-volt dynamo is highly efficient and its automatic voltage regulator gives correct current under all running conditions.

Model 226B. Handlebar control, **21/-** complete.
Model 226G. With switch on lamp, **21/-** complete.

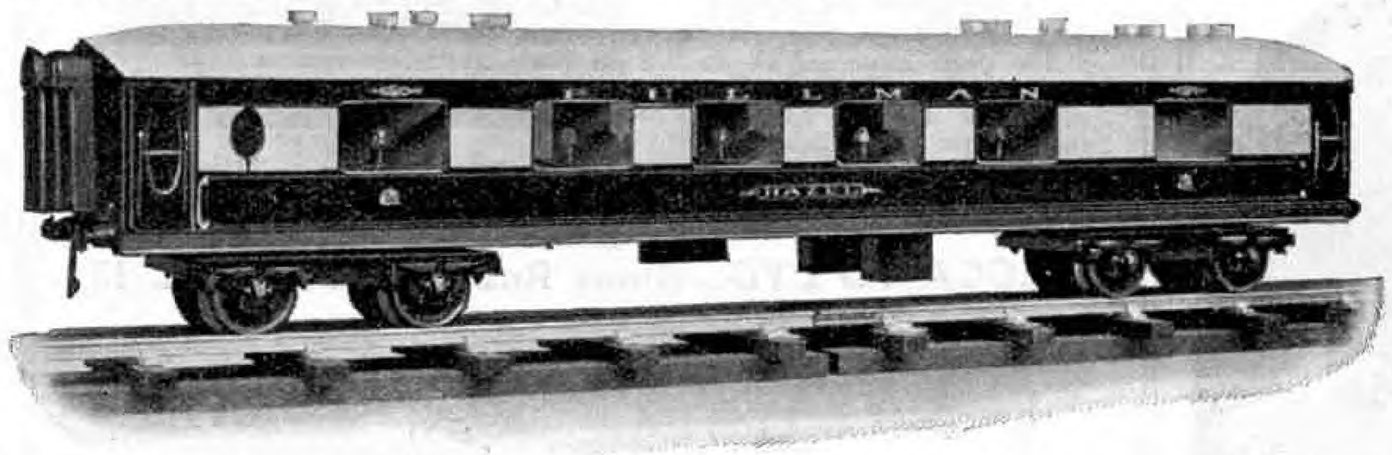
New 40 page Catalogue "M" 3d. post free

MODEL OWNERS should get the **"WILCO" 2-6 volt Motor.** Speedy, powerful. Works from 4-volt Pocket Battery, Accumulator, or Transformer. The **"WILCO" Transformer** reduces 200/250 volts to 2-8 volts. Capacity 3 amperes. Ideal for driving motors. **No. 112.** "Wilco" Motor, as illustrated, **7/6. No. 110.** As No. 112, but not enclosed, **5/-. No. 200.** "Wilco" A.C. Mains Transformer, **15/6.**

L. WILKINSON, 8, City Rd., LONDON, E.C.1



WE REPRINT our Model Railway Catalogue



Owing to unusual demand for our Section A.17 Model Railway Catalogues, we have just had to order another large reprint **including several important new lines.** The Model Pullman car illustrated is one item included, which every modern model railway owner should have. It is available in 1st class, 3rd class and 3rd class Brake End, gauge "O." Length 19". Price complete with internal fittings 65/-. YOU MUST GET A.17, price 6d. post free. Write for it now!

BASSETT-LOWKE LTD.

London: 112, High Holborn, W.C.1 — **NORTHAMPTON** — Manchester: 28, Corporation Street

TOYS OF QUALITY MADE BY MECCANO LTD.

KEMEX
CHEMICAL OUTFITS

The contents of the Kemex Chemical Outfits will provide many hours of fascinating fun. With the apparatus and materials contained in them a boy can make inks and soaps; dye wool, cotton and silk, and bleach fabrics that are already dyed; test foodstuffs for impurities; analyse air and water; grow crystals; make invisible inks and a chemical garden, and perform a host of other interesting chemical experiments.

No. O Kemex Outfit
75 Experiments

This Outfit includes a supply of specially selected chemicals, packed in airtight containers, together with a length of Magnesium Ribbon, sufficient to perform 75 attractive and varied experiments. A simple and highly efficient Spirit Lamp is included that makes the Outfit completely self-contained.
Price 5/-

No. 1 Kemex Outfit
130 Experiments

This Outfit includes the whole of the contents of the No. O Outfit, together with further chemicals and apparatus that increase the number of experiments that can be performed to 130. Price 7/6



No. 1 Kemex Outfit

No. 2L Kemex Outfit
250 Experiments

This Outfit includes the contents of the No. 1 Outfit, and further chemicals that increase the range of experiments up to 250. Price 15/-

No. 2B Kemex Outfit

This is exactly the same as the No. 2L Meccano Kemex Outfit, except that a highly efficient Bunsen Burner, with the necessary length of rubber tubing, is included in place of the Spirit Lamp. Price 15/-

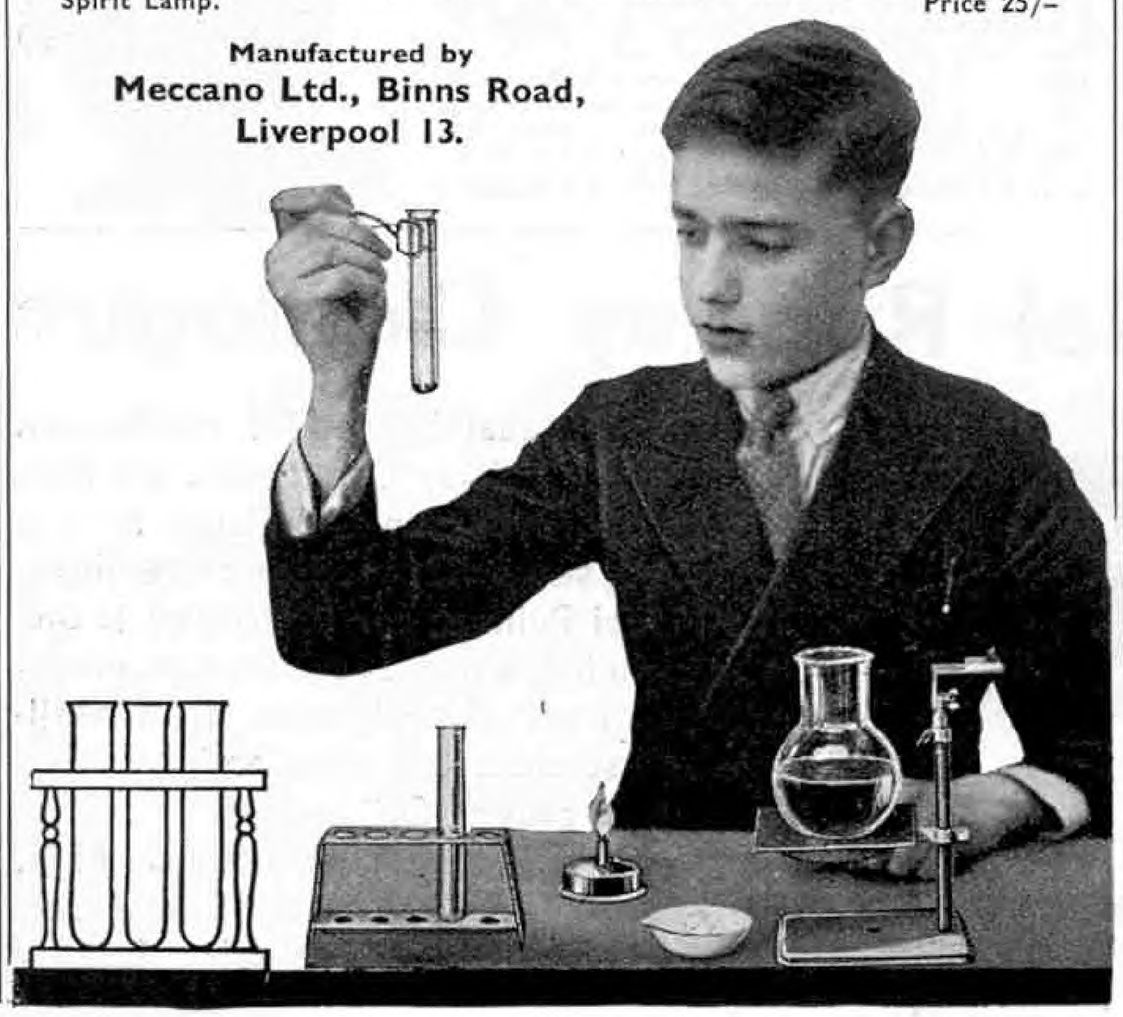
No. 3L Kemex Outfit
350-400 Experiments

This splendid Outfit enables a boy to carry out between 350 and 400 experiments. It includes the contents of the No. 2 Outfit, with additional chemicals and apparatus including a gas-generating apparatus, consisting of a large Wide-necked Flask with Thistle Funnel and Delivery Tubes, and a Blowpipe and a Charcoal Block. Price 25/-

No. 3B Kemex Outfit

This is the same as the No. 3L Meccano Kemex Outfit, except that a Bunsen Burner, with the necessary length of rubber tubing, is included in place of the Spirit Lamp. Price 25/-

Manufactured by
Meccano Ltd., Binns Road, Liverpool 13.



ELEKTRON
ELECTRICAL OUTFITS

In these days of radio, X-rays and electric trams and trains every boy should have a knowledge of electricity. The only way to gain this knowledge is by means of experiments, and the Elektron Outfits have been produced specially for this purpose. They provide the necessary material for carrying out a series of fascinating experiments in magnetism, frictional electricity and current electricity.

The No. 2 Outfit has the added attraction this year of a considerable price reduction.


In the above illustration is shown an electric bell being made with the contents of Elektron Outfit No. 1.



No. 1 Elektron Outfit Price 6/6

No. 1 Elektron Outfit
Magnetism and Static Electricity

The No. 1 Outfit contains two powerful Bar Magnets, a Horseshoe Magnet, and a reliable Magnetic Compass, together with everything necessary for the carrying out of a series of fascinating magnetic experiments. In addition there are materials for experiments in frictional or static electricity, and for the construction of an Electric Compass, two forms of Electroscope, and an Electrophorus. Price 6/6

No. 2 Elektron Outfit
Current Electricity

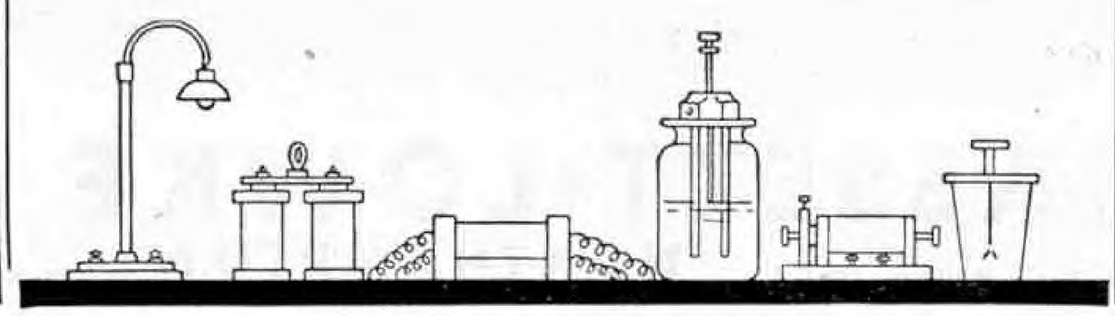
The reduced price of this splendid Outfit will make it more popular than ever. Everything that is necessary for a series of experiments with electric currents is included in the Outfit. It contains the parts required to make a Bichromate Cell, and to build a wide range of electrical devices, including Electro-Magnets, an Electric Bell, and a Buzzer for use in an electric telegraph system. A Shocking Coil that will give hours of fun, and two types of working Electric Motors also can be constructed from the contents of this Outfit. Price 17/6

The parts contained in the Elektron Outfits can be obtained separately. Ask your dealer for the Elektron Folder giving a list of Elektron parts, or write for a copy to the address below.



No. 2 Elektron Outfit Price 17/6

Manufactured by
MECCANO LTD., Binns Road, LIVERPOOL 13



TOYS OF QUALITY MADE BY MECCANO LTD.

DINKY TOYS *200 VARIETIES*

A FASCINATING COLLECTING HOBBY

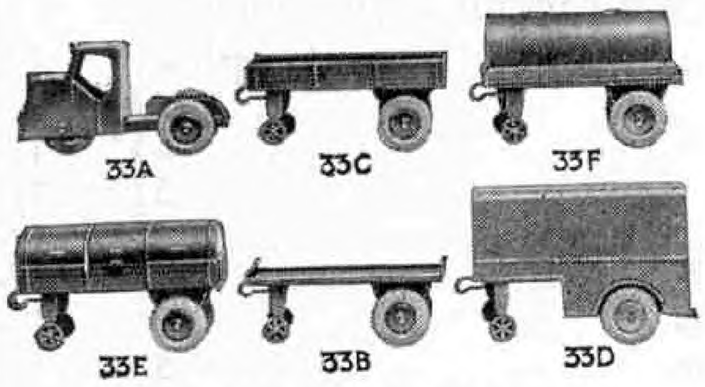
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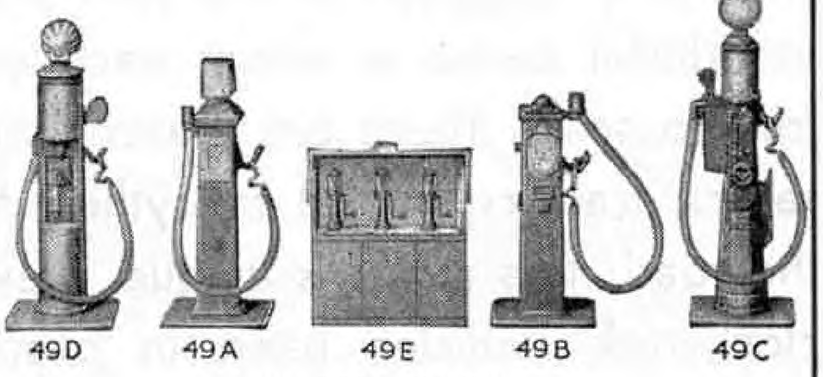
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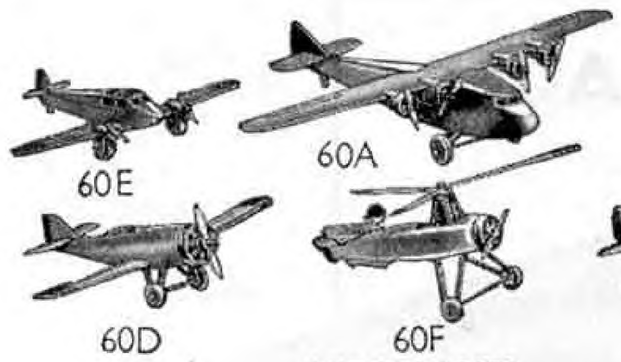
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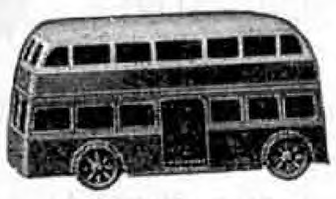
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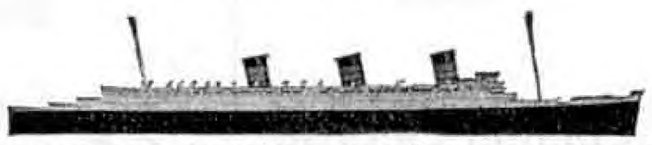
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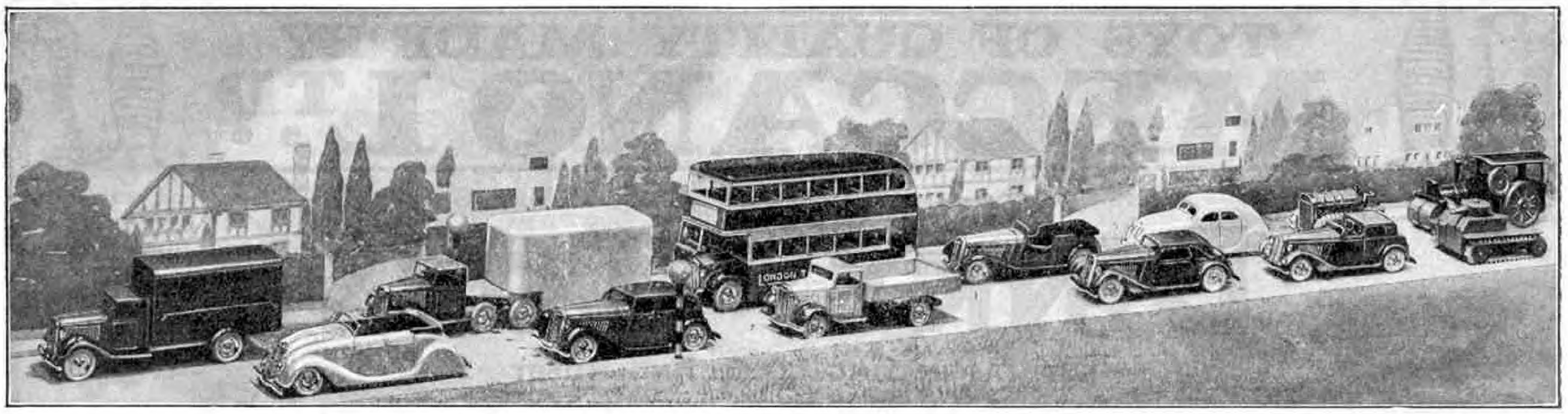
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DOLLS' FURNITURE

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NEXT MONTH: "ROMANCE OF MADAME TUSSAUD'S." READY: 1st OCTOBER

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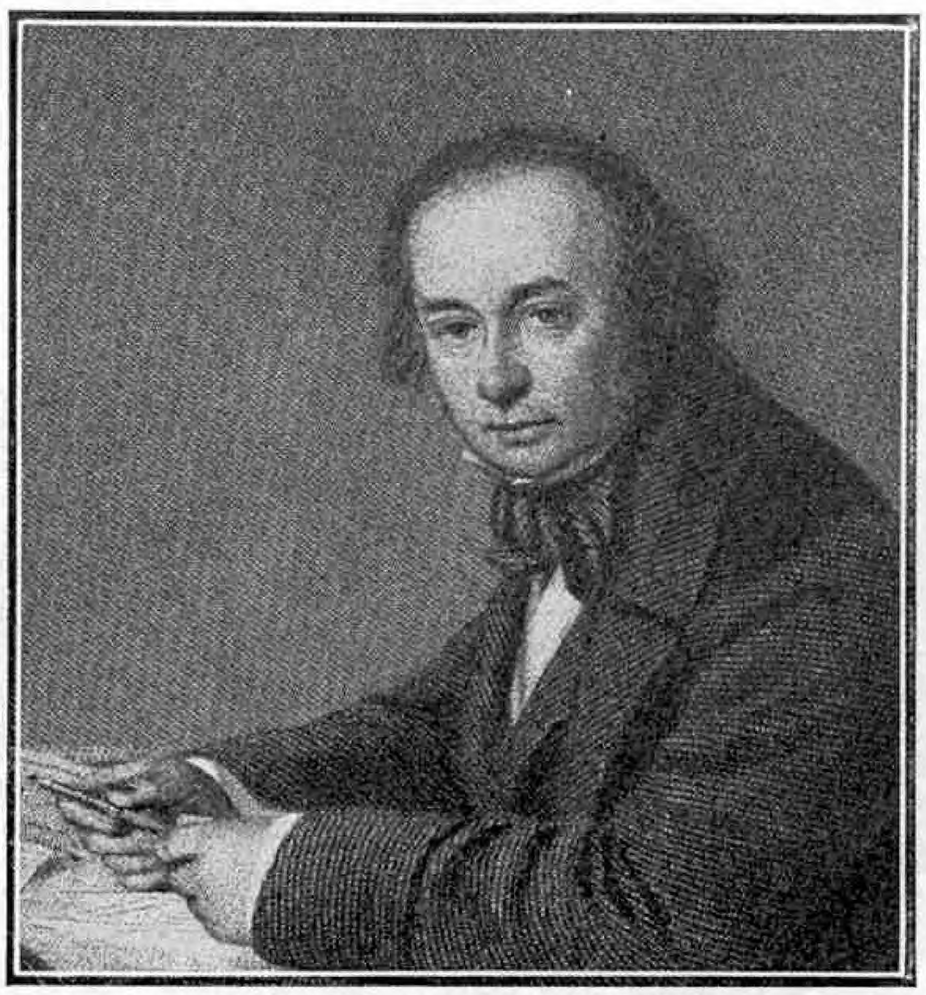
With the Editor

Brunel and the G.W.R.

The Great Western Railway, which celebrated its centenary on 31st August, is inseparably associated with Isambard Kingdom Brunel, its first chief engineer, for probably no other engineer has ever set the stamp of his personality so firmly on a railway. Brunel was only 26 when he was appointed engineer for the proposed line of railway from Bristol to London that formed the beginning of the G.W.R. He tackled his new duties with the impetuous enthusiasm that was so typical of him all through his life. He was here, there and everywhere, and we are told on good authority that he often worked for twenty hours out of the twenty-four. His ideas were in many respects far ahead of his day. There was then a tendency to regard railways as little more than an improved form of road, possessing certain advantages; but Brunel realised that an entirely new means of transport was available. At a time when twenty miles an hour was looked on as a dangerously high speed, he was planning the construction of a railway track so perfect that speeds as high as a hundred miles an hour could be achieved with safety. His permanent way proved to be too rigid, and his broad gauge of 7 ft. had to be abandoned; but he set the wonderful standard of speed with safety that is maintained by the G.W.R. to this day.

Bigness was always a characteristic feature of Brunel's schemes. On one occasion a director of the G.W.R. happened to refer in Brunel's hearing to what he considered the "enormous length" of the railway. "Why not make it longer," exclaimed Brunel, "and have a steamboat to go from Bristol to New York, and call it the Great Western?" His question was treated as a joke, but three years later the wooden paddle steamer *"Great Western,"* designed by Brunel, crossed to New York. She was the first steam-driven vessel to make regular voyages across the Atlantic. Later Brunel designed the *"Great Britain,"* the first really large iron steamship and the first large ocean-going vessel to be propelled by a screw. His final achievement was the *"Great Eastern,"* launched in 1858, and not exceeded in size for nearly 50 years. The *"Great Eastern"* was a failure economically, but for her time she was a triumph of engineering. She helped to make history by the part she played in laying the first Atlantic cable, and her construction definitely opened up new possibilities in shipbuilding and paved the way for such giants as the *"Normandie"* and the *"Queen Mary."* Brunel lived just long enough to see his great ship afloat.

A high tribute to Brunel and his *"Great Eastern"* was paid by Sir William H. White, the famous naval architect, in his address to the Institution of Civil Engineers in 1903. "Having recently gone again most carefully through Brunel's notes and reports," said Sir William, "my admiration for the remarkable grasp and foresight therein displayed has been greatly increased . . . . . Brunel displayed a knowledge of principles such as no other ship-designer of that time seems to have possessed . . . . . To him large dimensions caused no fear."



Isambard Kingdom Brunel, 1806-1859.

Gold-Plated Propellers!

It is remarkable how much energy has been spent throughout the ages in the attempt to acquire gold by other means than ordinary hard work. The early alchemists seem to have been firmly convinced that it would be quite easy to turn lead into gold if only they could find the secret. Later members of the profession seem to have been divided into two groups—those who still believed that they could make gold, and those who secretly realised that the thing could not be done, but kept up the pretence in order to extract money from credulous folks with more wealth than wits. In later times we have seen how a rumour that gold had been discovered would set swarms of men fighting their way across wild regions in North America or Australia.

For many years enthusiastic gold seekers have played with the idea of obtaining gold from the sea. This sounds rather a wild scheme, but gold actually does exist in the oceans of the world in immense quantities; in fact it has been calculated that there is more gold in the sea than out of it, the total quantity being over a million tons. The trouble is that there is so much water mixed with this gold. Every single ounce of the gold is associated with over 13,000 tons of sea water, and the difficulty lies in getting rid of all this liquid economically.

The process of extracting gold from the sea would therefore appear to be hopeless, but quite recently an American scientist, Professor Fink of Columbia University, has put forward a scheme that at any rate has the merit of simplicity. His plan is to pass an electric current from an anode, or positive pole, through the sea water to a cathode, or negative pole, that is rotated at a speed of 15,000 r.p.m., and he claims that in this way 90 per cent. of the gold may be recovered. This sounds interesting, but there is a more attractive idea to follow. Professor Fink maintains that similar results could be obtained by the use of ships' propellers as revolving cathodes, and that gold from the sea would be deposited on the propellers if wires were hung in the sea near them to act as anodes. If this scheme turns out to be practicable, an ocean voyage will become a gold-mining venture of an entirely new type; and every vessel making a long voyage will become a treasure ship with its propellers plated with gold!

When in Doubt, Write to the Editor

The articles that appear month by month in the *"M.M."* cover a very wide range of subjects, and it sometimes happens that interesting matters have to be dealt with briefly on account of limitations of space. I feel sure that readers often would like to have further information on some topic of this kind, and I take this opportunity of reminding them that I am always glad to help in any way possible. Write to me when you see in an article something about which you would like to know more, or something you would like to have explained.

The Waterwheels of Hama

A Picturesque City of Syria

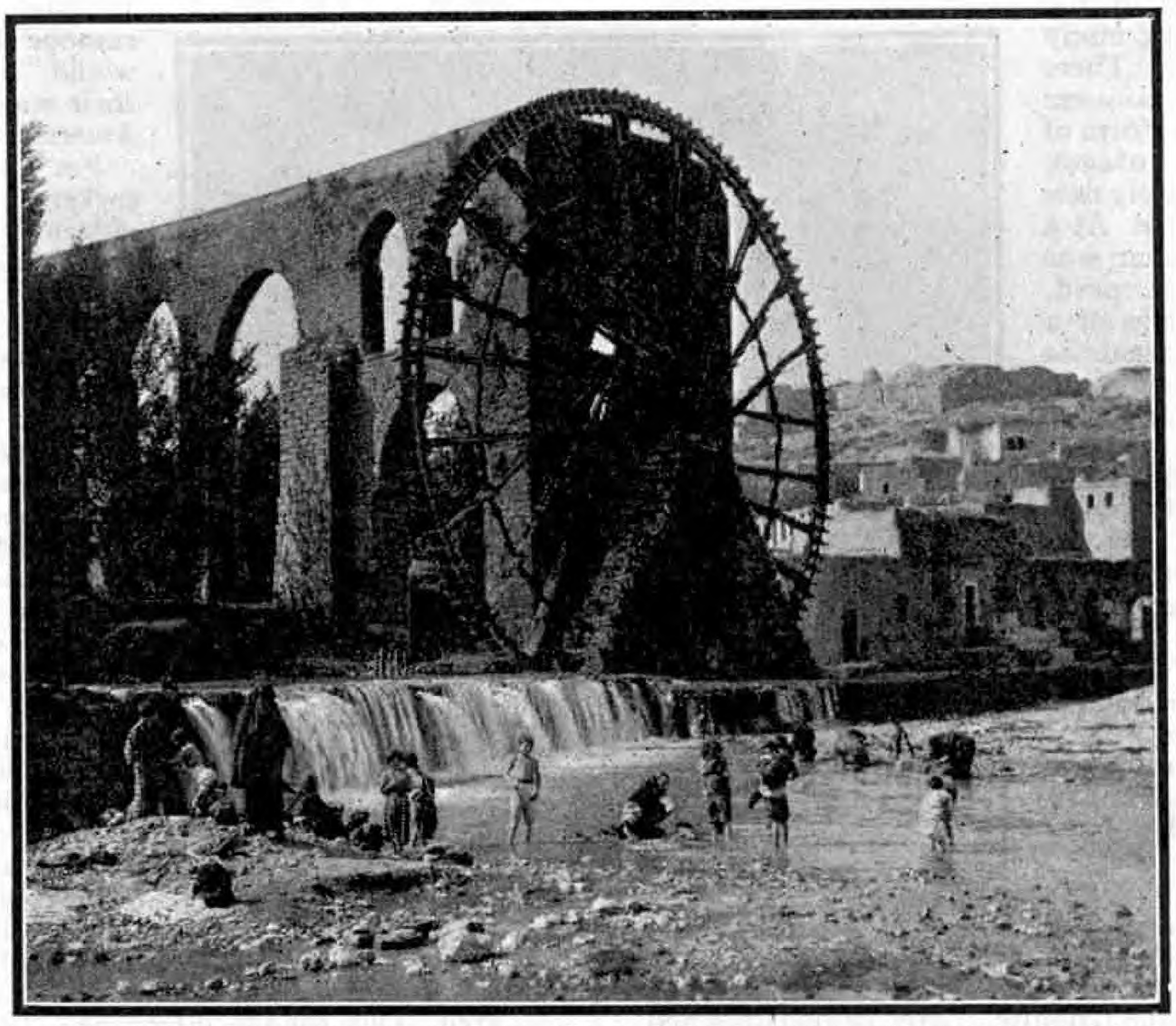
By Harold J. Shepstone, F.R.G.S.

THOUSANDS of tourists visit Palestine every season, but comparatively few venture over the border into Syria, which is governed to-day by France under a mandate from the League of Nations. Syria is in many respects a fascinating land, with great mountain ranges, deep valleys and picturesque scenery. It is situated in Asia Minor, and is bounded on the north by Turkey, on the south by Palestine, on the east by Mesopotamia, and on the west by the Mediterranean. Its area is about 60,000 square miles, and its population about 3,000,000, made up mostly of Orthodox Mohammedans, and a small proportion of Druses and Shiites. The French High Commissioner resides at Beirut, the capital and the chief seaport and commercial centre of the Lebanese Republic. This ancient town, which is one of the healthiest places along the coast, was once a port of the Phœnicians. Tripoli, another seaport, is likely to assume greatly-increased importance on account of being one of the Mediterranean termini of the 12,000-mile pipeline of the Iraq Petroleum Company, now under construction. An article on this remarkable pipeline appeared in the "*M.M.*" for March of this year. It is expected that the oil will start to come through the line to Tripoli next autumn, and preparations are now in progress for the loading of oil tankers.

Syria boasts of many famous cities and ancient ruins. Damascus, the capital, is one of the oldest cities in the world with a continuous history, and its first mention is in Egyptian records of about 4,000 years ago. It has a population of some 300,000, and still preserves its ancient oriental dignity in spite of Westernising influences such as electric light and cars. It contains the tomb of Saladin, and the "Gate of God" through which used to pass the pilgrimage to Mecca. There is also the "street called Straight," mentioned in the Acts of the Apostles in connection with the miraculous conversion of St. Paul while on his way to persecute the Christians of Damascus. This street, which runs through the city from east to west, was seriously damaged in 1925 when the city was bombarded by the French as a result of riots and other disturbances.

Damascus has given its name to damascening, the art of producing the well-known watered or striated structure on sword-blades and other weapons, and the ornamental incrustation of steel and iron surfaces with gold and silver. The familiar damson is actually the damascene plum; and damask, the name given to certain types of fabric with ornamental patterns, originated in the rich figured silks originally made in Damascus.

Another famous city is Aleppo, built on eight low hillocks surrounded by limestone hills, near the north-western extremity of the great Syrian desert. Before the earthquakes of 1822 and 1830 it was in many respects a fine city. Many of its most picturesque buildings were totally or partially destroyed during these earthquakes, among them the citadel, surmounting a great artificial mound supported, according to Arab tradition, by 8,000 pillars. One of the chief attractions of Aleppo is the gardens that extend along the banks of the river Kœik for some 12 miles.

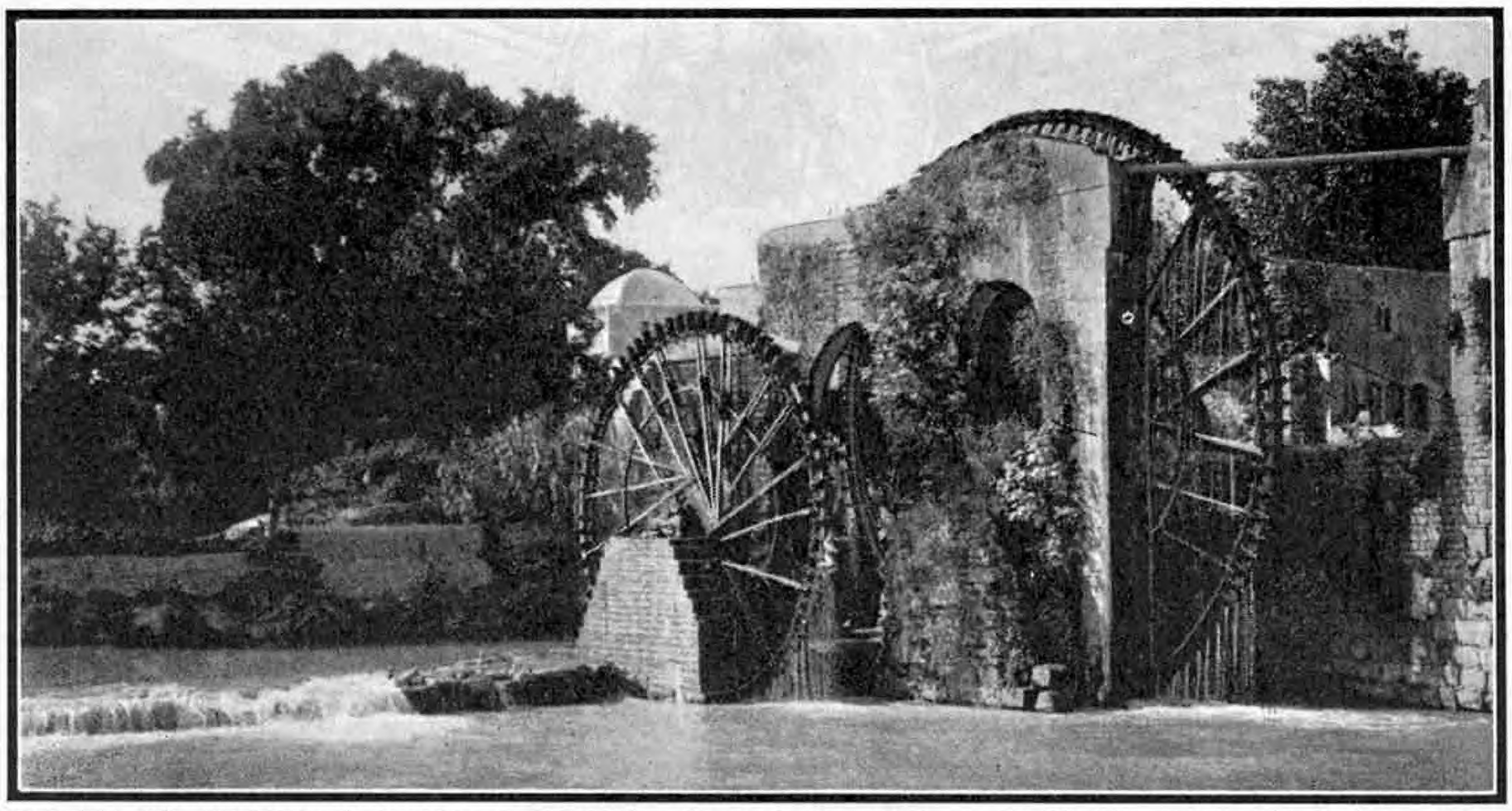


The largest of the four waterwheels at Hama. This is 75 ft. in diameter and is probably the largest water-raising wheel in existence.

Then there is Baalbek, on the western slopes of the Anti-Lebabon range, in ancient times famous among Syrian cities for the beauty and splendour of its buildings. Now it has fallen on evil days and is little more than a village of miserable dwellings; yet it maintains its fame by reason of its great ruins, which in many respects are the most wonderful in the world. The ruins consist mainly of three temples, the Great Temple, the Temple of Jupiter, Apollo or the Sun, and the Circular Temple. These are amazing structures for the period in which they were built. The preparation and placing in position of the enormous stones of which they are largely composed must have been a colossal task. One stone found near the ruins is believed to be the largest cut stone in the world. It measures 60 ft. by 17 ft. by 14 ft., and is estimated to weigh 1,500 tons.

In this article we are particularly concerned with another ancient Syrian city, Hama, formerly known as Hamath the Great. The name Hamath signifies a fortress or enclosed place. It was the principal city in Upper Syria from the time of the Exodus until that of the Prophet Amos, and is mentioned no less than 35 times in the Old Testament. It is between Damascus and Aleppo, and has always been an important place on the trade

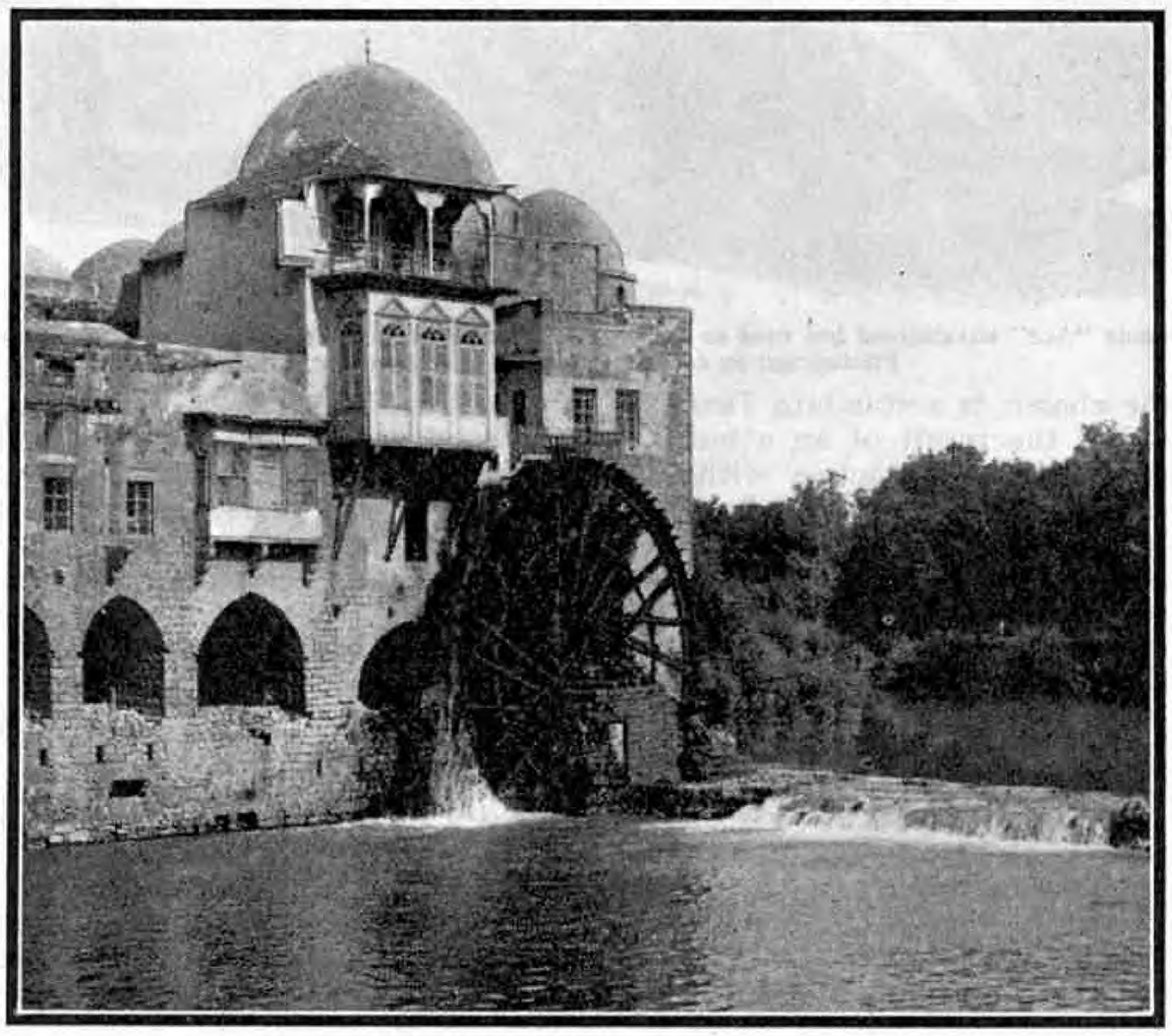
route from Assyria to Egypt. It lies in a narrow valley, and the pass to the south is probably the " entering in of Hamath " referred to in 1 Kings viii. 65. To-day the city has a population of some 60,000, engaged largely in the manufacture of silk, cotton and woollen goods, and gold and silver thread. The houses are principally of mud.



Two more of the giant waterwheels which are employed for raising water from the Orontes for irrigation purposes, and also for supplying the needs of the town.

For picturesqueness Hama is not to be outdone by any town in Syria. It stands amid poplar gardens, with a fertile plain to the west, and the broad River Orontes providing a constant element of beauty. The black and white striped towers of the mosques form an exquisite architectural feature, and the narrow, partly vaulted streets are traps to hold unrivalled effects of sunlight and shadow. The bazaars, as yet, are not disfigured by the iron roofs that have done so much to destroy the character of those at Damascus and other Syrian cities. The great mosque in the centre of the town was once a Byzantine church, and the doors and windows of the earlier Christian building are easily traceable in its walls.

To the ordinary visitor, however, the greatest attraction of Hama is its waterwheels. The Orontes flows through the city in the form of the letter S, and upon its banks are four huge waterwheels used for drawing up the water of the river for irrigation purposes, and also for supplying the needs of the town. The wheels are driven by the flow of the river on what is known as the undershot principle, in which the wheel is moved by water passing beneath it.



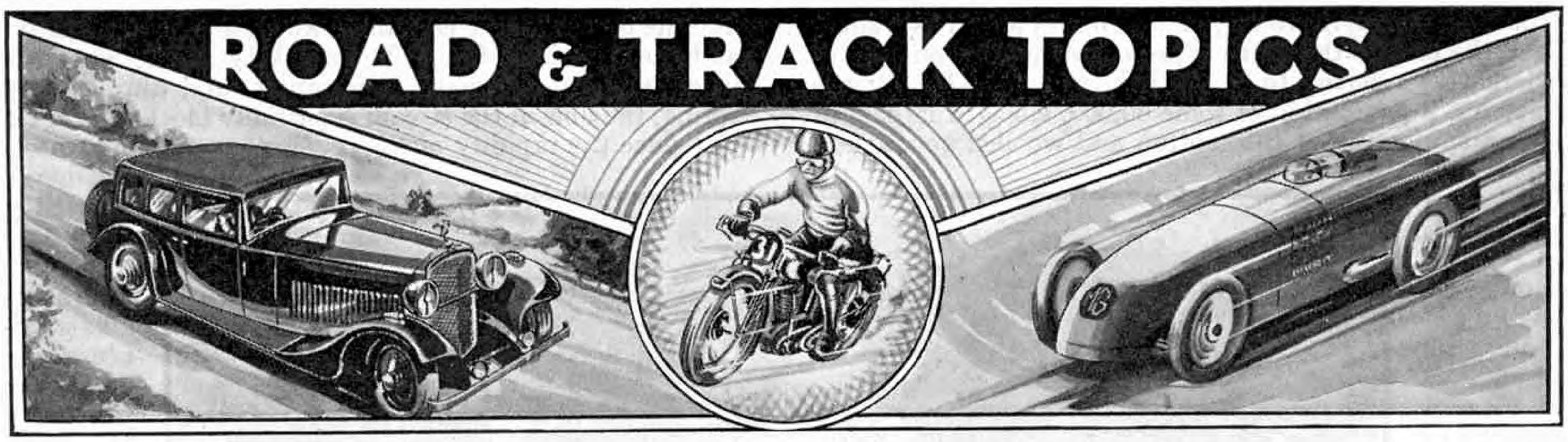
A smaller waterwheel for raising water for domestic purposes.

The largest wheel has a diameter of about 75 ft., and is almost certainly the largest water-raising wheel in existence. On its outer rim is a series of wooden buckets that raise the water and deposit it in the stone aqueduct above, from which it is carried to the surrounding orchards and vineyards. This, like the other wheels, is built of wood, a dark mahogany, and the axle is of iron. The creaking of the wheels is incessant day and night. In winter, and during early spring, the flow of the stream is partially blocked in order to reduce the rapidity of the revolutions, but the wheels are never actually stopped.

These remarkable structures are the property of four influential Mohammedan families, after whom they are named. In the olden days these families were the ruling lords of Hama and the surrounding district. An ancient and gruesome story is told concerning the owner of one of the waterwheels. This prince strongly desired a neighbouring vineyard, which the owner refused to sell. Thereupon the great man laid a deep plot in order to secure it. He caused one of his slaves to be slaughtered and cut in pieces, and had him buried, but not too deeply, in a corner of the coveted property. After waiting a suitable time he informed the landlord that he would accept the invitation frequently given by him to drink coffee in his garden.

The man was gratified by this condescension, and spread a feast for his guest in an arbour. When the prince arrived, he declared that the spot selected did not suit him, and led the way to the corner of the garden in which, as he knew, the slave had been buried. The host protested, saying that there were heaps of refuse near the place, but the great man insisted, and the entertainment began.

Presently the guest said he detected a curious smell. His host attributed this to the rubbish, but the prince pretended to be dissatisfied, summoned his slaves, and ordered them to dig, with the result that the slave's dismembered body was "discovered" and identified. The landlord was immediately accused of murder, and compelled to give up his vineyard as compensation to the crafty prince.

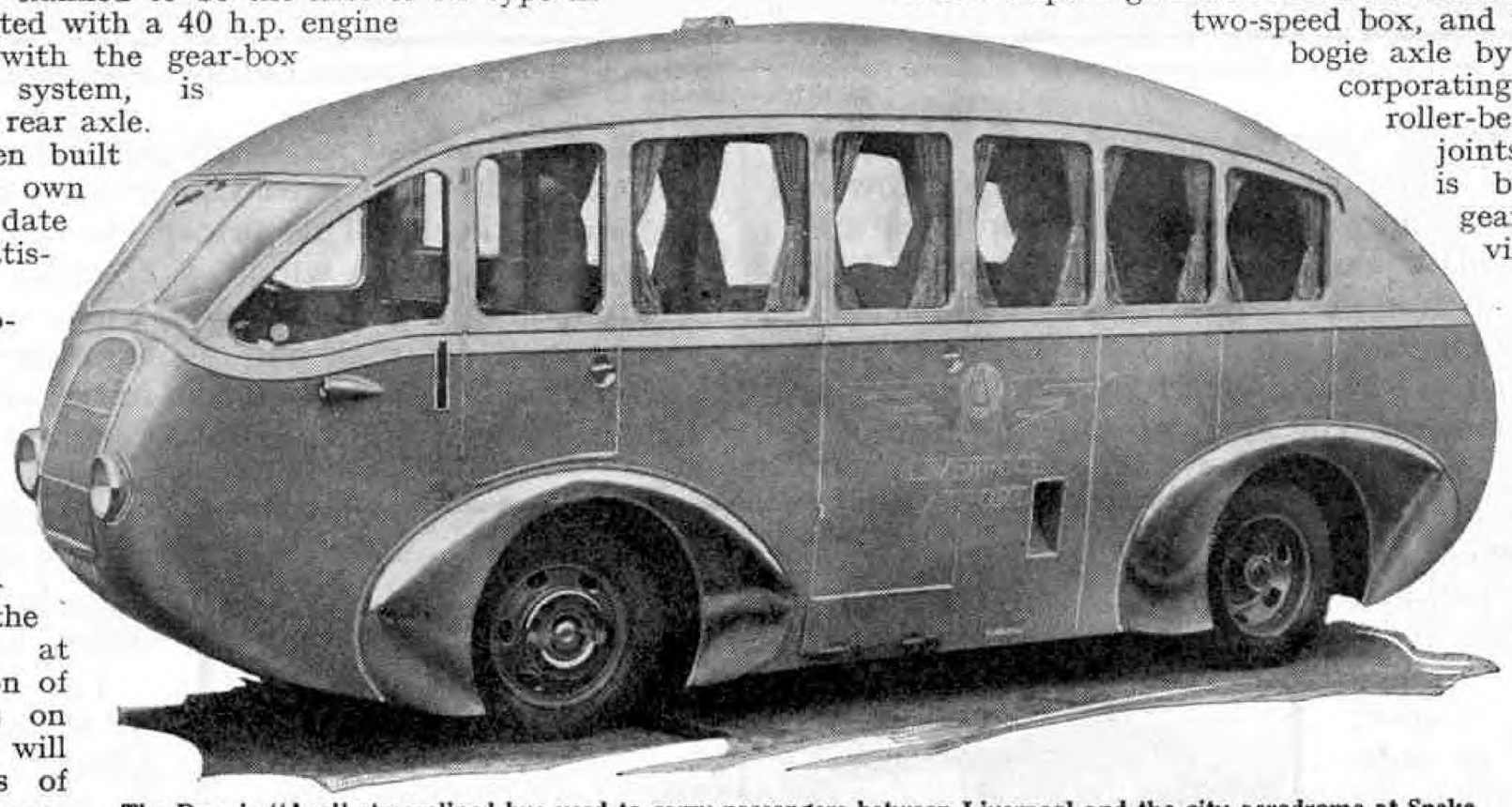


A Rear-Engined Omnibus

Many attempts have been made in the past to produce a satisfactory motor vehicle with the engine and its transmission mechanism at the rear instead of at the front, as is usual. This arrangement has the advantage that more body space can be obtained, but it introduces complications in the controls and the design of the gear-box and clutch. Well-known early examples of rear-engined cars included the G.W.K. and the Trojan, and a more recent introduction is the Burney streamlined 7-seater.

The latest development in rear-engined vehicles is a 40-seater bus that has recently been placed in service by the Birmingham and Midland Motor Omnibus Co., Ltd., on the Birmingham-Langley route. The bus was designed by the chief engineer of the Company and is claimed to be the first of its type in the country. It is fitted with a 40 h.p. engine and this, together with the gear-box and transmission system, is mounted behind the rear axle. The vehicle has been built at the Company's own works and up to date has given every satisfaction.

The increasing application of streamlining to public service vehicles is exemplified by a novel bus that is now in service at Liverpool for carrying passengers between the City and the Liverpool Airport at Speke. An illustration of the vehicle appears on this page, and it will be seen that it is of unusual appearance. Apart from the fact that it is fitted with forward control, the chassis is a standard Dennis "Ace," and the design of the body is the result of an attempt to produce an outline suggestive of aircraft practice without sacrificing seating capacity. The wing panels have a slight inward taper outside the wheelbase, the radiator is concealed by a decorative grille in the tapered front of the body, and the headlights are sunk into the front panelling. Entrance to the body is by means of a hinged door, fitted with an automatic falling step, which is placed behind the elongated front wing on the near side. In the interior are a number of shelves for baggage and seats for 12 passengers.



The Dennis "Ace" streamlined bus used to carry passengers between Liverpool and the city aerodrome at Speke. Photograph by courtesy of Dennis Brothers Ltd., Guildford.

Tank Lorries Carrying 14½ Tons of Petrol

Two other new vehicles of considerable interest, but of a very different type from those already mentioned, have recently been placed in service. These are two giant 10-wheeler Scammell oil tank motors, each capable of carrying 4,200 gallons of liquid fuel, that have been built for the Anglo-Persian Oil Co., Ltd. The two vehicles are practically identical, and one of them is illustrated on the opposite page. They are in use overseas to carry liquid fuel in bulk from refineries to various depots with which there is no communication by pipe line, and although they normally will traverse proper roads, they are equipped to travel over rough ground and to negotiate steep hills. As an example of the kind of work which they are to be called upon to do, it may be mentioned that on one of their regular routes the road rises to nearly 10,000 ft. above sea level, and includes long stretches of steep gradients with nearly 40 hairpin bends.

Each vehicle weighs about 13½ tons unladen, and can carry about 14½ tons of petrol. The layout of the chassis is based upon that of the well-known Scammell Pioneer, but the axle, transmission, and some other parts are considerably heavier. A modified Parsons "straight eight" marine engine is used. This has a bore and stroke of 4¾ in. and 6 in. respectively, and develops 168 b.h.p. at 1,650 r.p.m. It is mounted in a sub-frame rigidly carried on the main frame, and the eight cylinders are cast in pairs. Inspection doors are provided on both sides of the crank-case to allow access to the crankshaft and big-end bearings, and magneto and coil ignition with separate plugs and distributors are used.

The crankshaft torque is transmitted through a standard clutch to a five-speed gear-box and from there to a double-layshaft two-speed box, and thence to the fixed bogie axle by a short shaft incorporating two Hardy Spicer roller-bearing universal joints. The final drive is by trains of spur gears to the four driving wheels.

The main braking system is of the compressed-air type, incorporating the latest Dewandre pressure-servo gear, and is operated by either a pedal or a hand lever. There is also a Neate brake, by which the trailing-wheel brake shoes can be applied by cable. A further brake control lever is mounted below the tank to facilitate manœuvring when parking. Compressed air for brake operation is provided by a two-cylindered water-cooled compressor, driven by the engine auxiliaries, and is stored at a pressure of 80 lb. per sq. in. in a container at the back of the cab.

Within the cab, mounted on the dashboard, are tanks for drinking-water and a reserve of lubricating oil, and provision also is made for a man to sleep, lying fore and aft, on the floor of the cab at the near side.

Great German Motor Highways

Many British motorists will read with some envy the news that a unique system of motor highways, to comprise 4,400 miles of roads specially designed for high-speed traffic, is now being constructed in Germany. A total length of about 500 miles of this system, distributed in various parts of the country, will be finished by the end of 1935. The roads are laid wherever possible, through free forest and agricultural country, and the first stretch of completed highway, which lies between Frankfort-am-Main and Darmstadt, is now open to traffic.

The roads have two carriageways, which are divided by a belt of grassland planted with shrubs chosen specially to prevent dazzle. Each roadway is 7½ metres, or 24½ ft., in width, and is marked down its centre with a white or black line, according to whether it is made of concrete or dark macadam. The curves are banked and vehicles are able to negotiate them with practically

no diminution in speed, a matter of importance to powerful cars.

It is interesting to note that in making the roads particular care has been taken not to spoil the natural beauty of the country through which they pass.

A Speed Limit Warning Device

Since the introduction of the 30 m.p.h. speed limit in this country several ingenious devices have been placed on the market for the purpose of warning drivers when they are in danger of exceeding the limit. One of the most interesting of these consists of a small unit that can be attached to the end of the ordinary speedometer flex, and operates a warning light fixed on the dashboard or other place where it can be easily seen by the driver.

In order to enable motorists to check the accuracy of their speedometers while actually on the road the Automobile Association has provided a fleet of cars equipped with specially checked speedometers, which operate on various unrestricted roads. The cars are in charge of A.A. officials and they display notices inviting motorists to check their speeds against the A.A. speedometers. At a number of important points on main roads are special notices that mark off measured miles, so that motorists can test their speeds for comparison with the readings of their speedometers.



A giant 10-wheeler Scammell Oil Tanker capable of carrying 4,200 gallons of oil fuel. It is one of two similar vehicles built for service overseas, and is equipped to traverse rough country should occasion arise. Photograph by courtesy of Scammell Lorries Ltd., London.

New British World Speed Records

In the "Road and Track" pages of the July "*M.M.*" I referred to the attempt to regain the 24-hour record for Great Britain that was to be made by J. Cobb with his 450 h.p. Napier-Railton car, at Salduro, in the United States. As readers will know, this attempt was completely successful, Cobb and his two assistants, T. E. Rose-Richards and C. J. Dodson, completing 3,235 miles in the time allowed, their average speed being 134.7 m.p.h. The previous record for 24 hours continuous running was held by the American driver, A. B. Jenkins, who on the same course maintained an average speed of 127.22 m.p.h. for the 24 hours, covering a total distance of 3,053 miles.

This great achievement is a wonderful triumph for British motor engineers. Cobb and his fellow drivers had to face a gale during the night, and the blistering heat in the middle of the day softened the salt surface of the course and reduced speed, in addition to making conditions uncomfortable. In a previous run Mr. Cobb broke the world's hour record, the 50 and 100 mile records, and those for 50, 100 and 200 kilometres, and as the result of his two great efforts he now holds all world's records between 50 kilometres and 4,000 kilometres, and from one hour to 24 hours. The only records Mr. Cobb did not break were those of Sir Malcolm Campbell's for distances from one kilometre to 10 kilometres, and the 10-mile record, held by "Wizard" Smith, the Australian driver, who in 1932 averaged 164.08 m.p.h. over a course in New Zealand. Thus an imposing array of world speed records on land is now again in British hands. The Napier-Railton car with which the new records have been made is fitted with a 12-cylinder Napier supercharged engine.

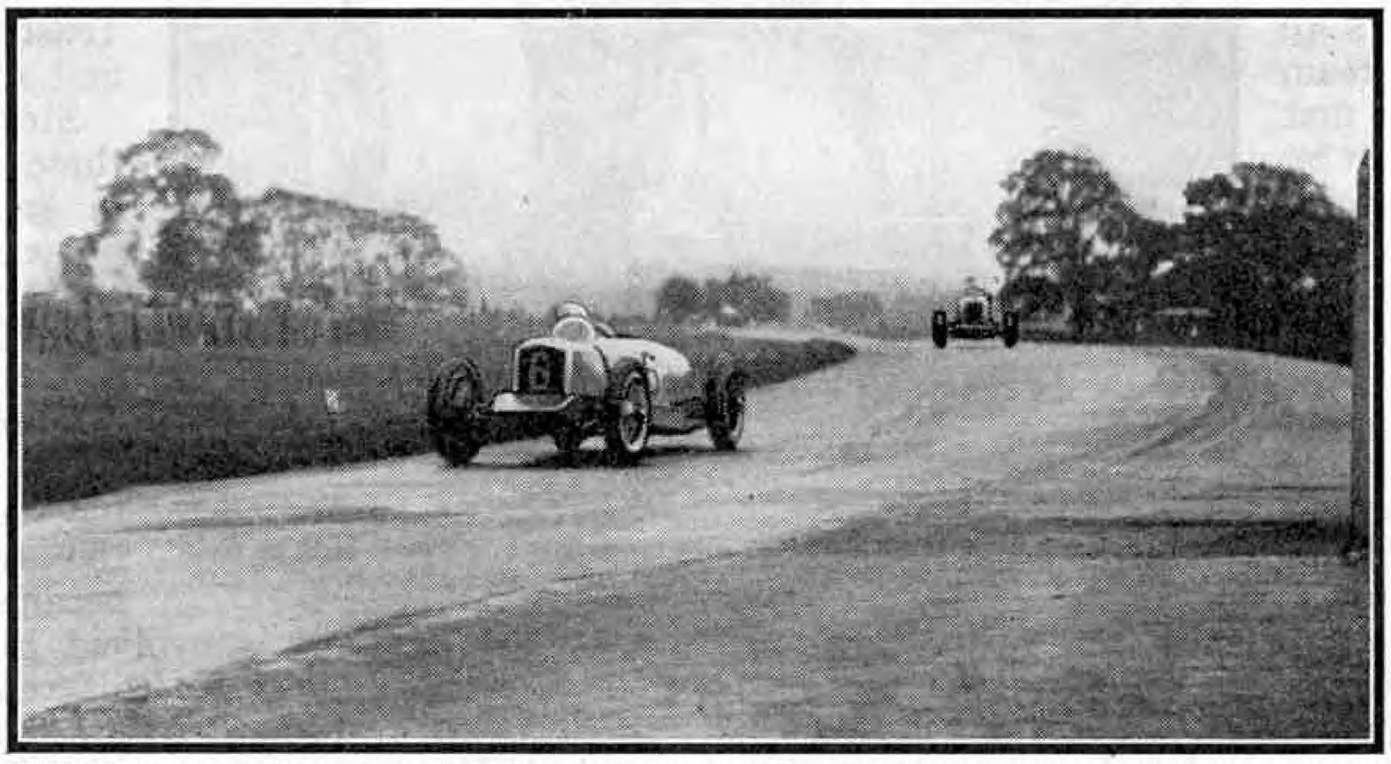
E.R.A. Success at Donington Park

While Cobb, Dodson and Rose-Richards have been busy creating new records abroad, motoring events nearer home have been full of interest. The Nuffield Trophy at Donington Park was won by P. G. Fairfield driving the only E.R.A car in the race. The young South African won the race in great style, and thus repeated his success in the Mannin Beg race earlier in the year with the same car. The race was over 150 miles, made up of 60 laps, and there were 21 starters. It was only at the 47th lap that Fairfield took the lead, after P. Maclure in a Riley, which up to that point had put up a splendid performance, turned in to his pit. Maclure's stop was very short, however, and he was soon off again and managed to keep second place.

The British Empire Trophy Race was a triumph for Riley cars. It was run over 80 laps of a three mile course, and was won easily by the popular Brooklands driver, F. W. Dixon, piloting a Riley 1986 c.c. machine at a speed of 75.47 m.p.h. The course was made difficult by the introduction of three artificial bends, and these were so severe that cars had to slow down almost to a crawl to negotiate them, so that the race lost much as a spectacle. E. McClure and C. Paul, both piloting Rileys, occupied second and third place.

British Racing Triumphs Overseas

Most of the big racing events of the 1935 season will have been decided by the time these lines appear in print, and whatever fate may attend British cars in the remaining fixtures, the British motor industry has every reason to be pleased with the results up to date. Both in this country and on the Continent 1935 has been a highly successful year for British cars and drivers. Among outstanding achievements it will be remembered that at Le Mans recently a Lagonda and an Aston-Martin won the Grand Prix d'Endurance and the Rudge-Whitworth Cup respectively. This was the first occasion since 1930 on which Britain has won the Grand Prix, and an Aston-Martin and a Riley finished third and fourth respectively in this race. Another noteworthy British success was that of four E.R.A. cars, which were placed first, third, fourth and fifth in a 113-mile race for cars not exceeding 1,500 c.c. capacity, held in Germany recently, the British entrants beating crack cars of Italian and German make.



F. W. Dixon, the well-known racing driver, at speed on the Donington Course, hotly pursued by Humphrey Cook in an E.R.A. machine. Courtesy "The Riley Record."

More Speed Records

Since my notes on J. Cobb's success on the Salduro speed course were written, three of the 20 records set up by him and his colleagues have been broken by the former holder, A. B. Jenkins, who registered speeds of 152.145 m.p.h., 151.72 m.p.h. and 151.316 m.p.h. respectively for the hour, 200 miles and 500 kilometres.

The struggle for motoring records is now intense. A wonderful new car has been built for G. E. Eyston, who is taking it to America and hopes to regain for Britain the records lost to Jenkins and to set up new figures for other distances.

The Story of the Road Roller

From Horse Haulage to Diesel Drive

By R. S. McNaught

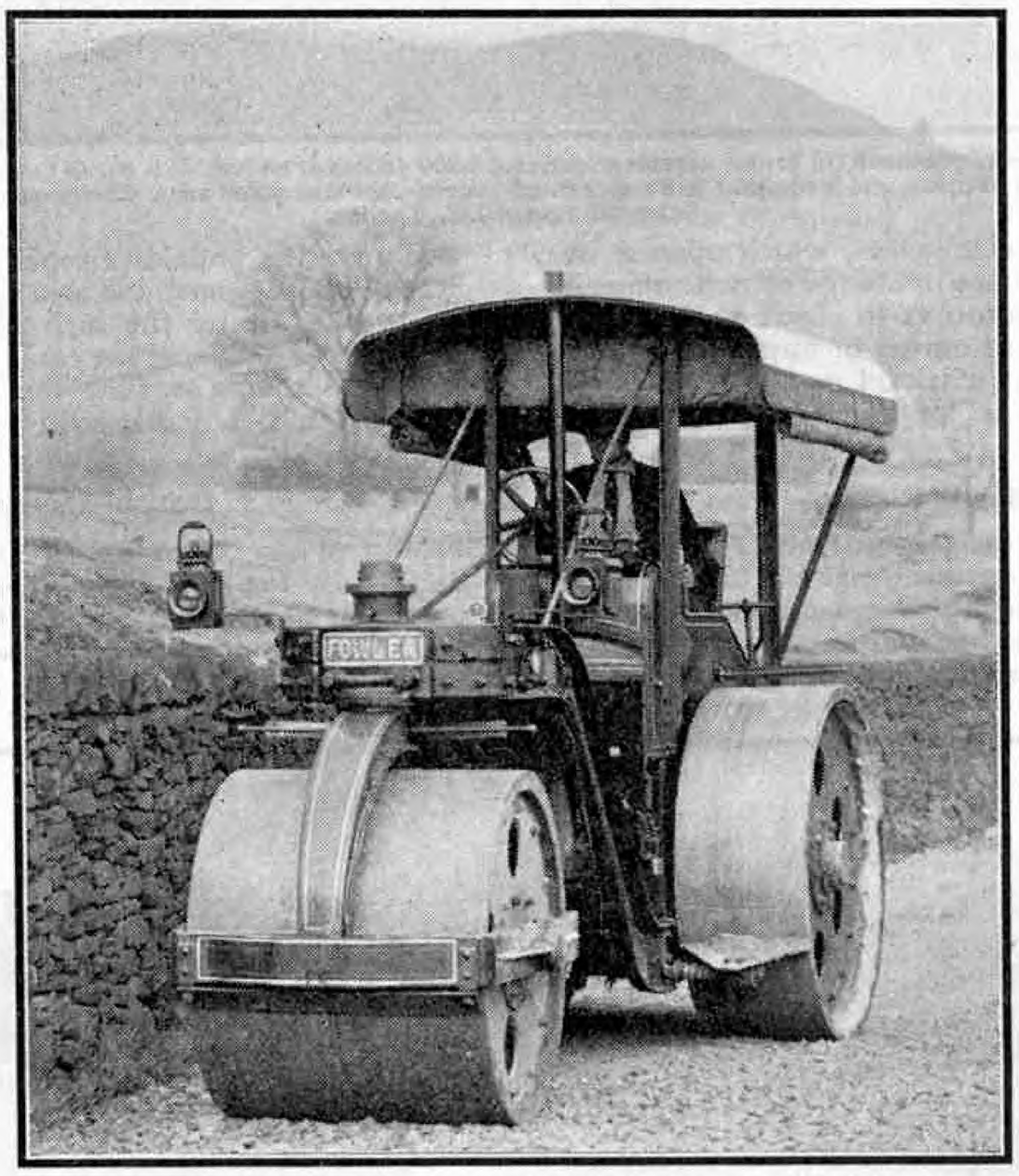
BEFORE the early part of the 19th century very little was attempted in the rolling of roadways, either in construction or repairs. With the growth of traffic, highway engineers became faced with the problem of finding surfaces able to resist the wear and tear of heavier vehicles moving at greater speeds. Before Macadam introduced the water-bound surface, dry stone loosely "dressed" and left for the passing traffic to knit into a hard but irregular surface was in general use, and the condition of most roads was very bad.

A horse-drawn roller of cast iron, weighing some 7,000 lb., was made by a French contractor in 1787, but it never outlived the experimental stage. In 1817 an Englishman named Phillip Clay patented a horse-roller surmounted by a form of carriage that could be loaded with weights, and horse-rolling with a contrivance of this kind became fairly general in Western Europe.

The chief difficulty with horse-drawn rollers was the displacement by the horses' feet of stones forming the metalled road surface, and this factor led engineers to experiment with steam power. Early in 1859 the first steam road roller was built by a Frenchman, Louis Lemoine of Bordeaux. This machine was a development of the earliest type of road traction engine. It weighed 10 tons and was steered by means of gearing and a pair of guide wheels. In 1860 another steam roller was patented in France by a M. Ballarson. Two years later experimental trials were carried out by the French State engineers with both these pioneer machines, the outcome being a verdict strongly in favour of steam rollers generally, and of Ballarson's design in particular. Economy was not a strong point with this engine, however, as it used 4 cwt. of coal per hour. Its general design also was faulty, the road surface being left in ridges somewhat resembling the waves of the sea.

The first steam roller built in this country was the joint design of Mr. Black, municipal engineer of Calcutta, and Mr. W. Batho of Birmingham, in which city it was built in 1863. After trials it was shipped to India, and two similar machines built in the following year, but in London, were also sent to work in Calcutta. The principal feature of these machines was the use of three sets of rollers, two in front acting as drivers, while the third couple was set in a turntable in rear, which steered the machine and covered the road surface missed by the outside drivers in front. It will be noticed that the conventional design for later steam rollers involved a complete reversal of this arrangement.

The first really successful steam roller to be worked in Great Britain was built by Aveling and Porter Ltd., a Rochester firm of engineers whose steam rollers and other traction machines have since made for themselves a world-wide reputation. This roller was built after trials in Hyde Park, London, with a traction engine having broad rollers substituted for ordinary road wheels. It was constructed for the Corporation of Liverpool in 1867, and it weighed 30 tons—an enormous weight that proved quite excessive—and cost £1,000. The massive proportions of the Liverpool roller are well shown in the illustration on page 507. A machine somewhat similar to the "Liverpool Roller" was set to work by the Edinburgh City Road Trust in 1870, and was the first steam roller in Scotland.

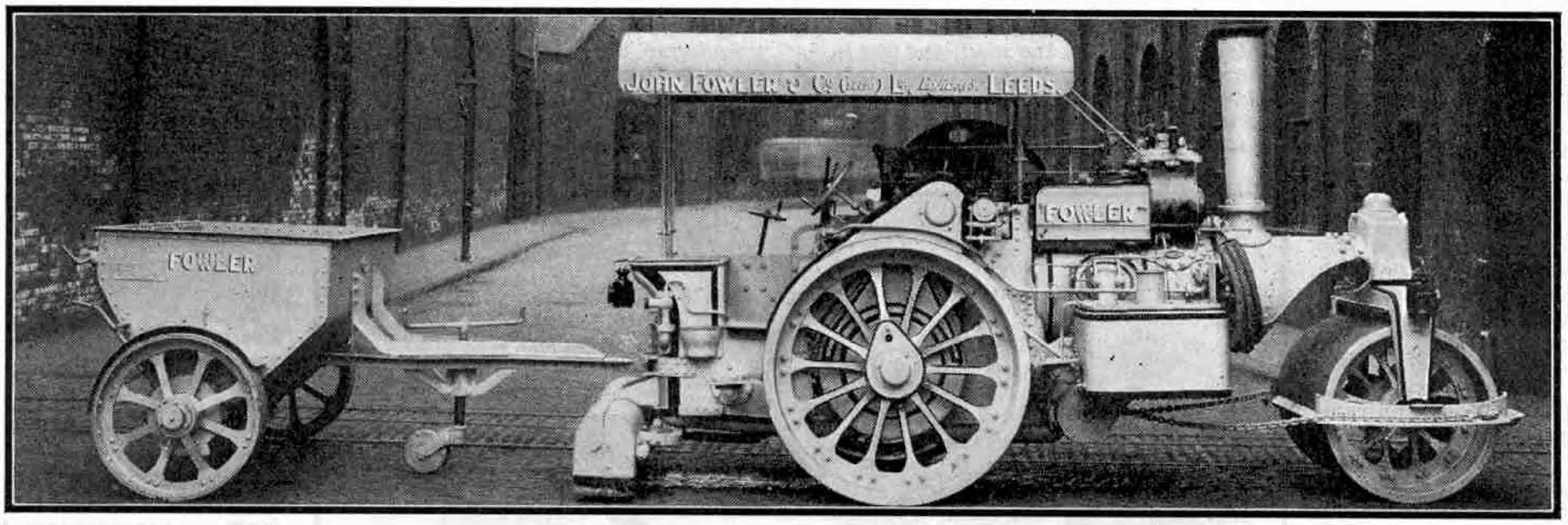


Fowler "Precision" 33 h.p. Diesel-engined road roller at work. It is interesting to compare this machine with the "Five-in-One" roller, shown in the upper illustration on the opposite page, which carries its own tar sprayer and gritter. Both of these photographs are reproduced by courtesy of John Fowler and Co. (Leeds) Ltd., Leeds.

Steam rollers evolved from these early designs were built in great numbers for both home and foreign service, and while other engineering firms speedily adapted their plant to the turning-out of efficient machines, credit must be given to the Rochester firm for their pioneer work, and the fact that what soon became regarded as the conventional design was evolved by them.

A short description of this general design will be of interest, an up-to-date Aveling roller being selected as typical. The modern tendency is to use as light a roller as possible, on account of the different methods of road-making that are now adopted. For many years 10, 12 or 15 tons was a common weight for rollers in this country, while examples scaling as much as 20 and 25 tons have been built for overseas use, notably in France and Spain. Two rollers are frequently used for tar macadam jobs, a 5-6 ton quick-reverse machine to be used first lengthways and across, followed by a heavier roller 15-18 tons to complete the operation.

Steam rollers are of either the single or the compound type. The advantages of the latter, although it involves



greater initial cost and heavier repairs, are economy in fuel and water consumption, and less noisy working, as the exhaust is discharged into the atmosphere at a relatively low pressure. The double-cylinder also gives a more easy turning motion than is the case with single-cylinder simple engines.

The boiler is of the ordinary locomotive type, the cylinders being mounted on the forward end and surrounded by a steam jacket. Steam is taken direct from the boiler, which is pressed to about 140 lb. per sq. in. simple, or 180–200 lb. compound. Belpaire fire-boxes were introduced about 1904, made of steel with steel stays in the sides and crown. Special types of fire-boxes for burning wood or inferior coal are often fitted to engines for service overseas. A pair of Ramsbottom safety valves are usually fitted above the cylinder chest.



A steam road roller built by Aveling and Porter Ltd., in 1867 for the City of Liverpool Corporation, provides an interesting example of engineering of the past. Photograph by courtesy of Aveling-Barford Ltd., Grantham.

Slide valves for regulating the steam supply to the cylinders are superseded nowadays by the more efficient and frictionless piston valves, as is the case in up-to-date locomotive practice. The use of Stephenson's link motion for operating the valves is practically universal, and mechanical lubricators for the cylinders are also modern standard fittings.

Power is transmitted from the crankshaft—on which is keyed a heavy flywheel adapted for belt driving—to the driving axle by means of a train of cast steel gear wheels. This gearing generally provides for two road speeds controlled by levers on the footplate. The brackets for carrying the gearing are formed by the side-plates of the fire-box being extended upward and backward in one piece. A screw friction brake is operated from the footplate, and steering is achieved by a worm and screw controlling the steering chains fixed to the front rollers. The tender, carrying a small supply of coal and a tank for feed-water, is made of steel plates with flanged edges.

The rear wheels, which drive the engine and also roll that portion of the road surface not covered by the leading rollers, are readily detachable. As they are built of cast iron their life is necessarily much shorter than that of the engine generally, and to equalise wear of rolling tyres they are often changed over. In a 15-ton steam roller their diameter is about 6 ft., and the width of the rolling tyres 20 in. The leading rollers, or more precisely the leading roller in two half-sections, is also made of cast iron, about 4 ft. in diameter with a combined width of 4 ft. 6 in. The forecarriage on which the front roller is mounted, is fixed to the specially strengthened smoke-box of the boiler by a spindle working in a heavy bracket. Provision is made for this spindle to have sufficient play to allow the rollers to accommodate themselves to the contours of the road.

The usual weight distribution is two-fifths on the front rollers and three-fifths on the rear ones. When the machine is at work on a gradient, these proportions naturally alter, owing to the effects of gravity and the movement of the water in the boiler.

Improvements incorporated in the latest standard "Aveling" design include the provision of an injector instead of force-pumps for the boiler feed-water, with automatic shut-off twin valves. In compound engines the cylinders are so designed that the cranks are close up to the bearings instead of in the middle of the crankshaft, thus reducing strain on the boiler generally.

In 1880 a steam ploughing locomotive of the then standard type built by John Fowler and Co. (Leeds) Ltd., was converted into a steam roller, and proved to be the pioneer of a very successful design that has since been improved upon and greatly multiplied. Special attention has been paid by this firm to the possibilities of a steam roller which, by incorporating several separate functions, can tar its own road surface in addition to rolling it. These features are embodied in the latest type of Five-in-One Fowler patent roller, which is being used to an increasing extent both in Great Britain and the Colonies.

The ordinary procedure of repairing tarred roads, or

"grouting" as it is called, will be familiar to most readers. The stone is laid and spread in a dry condition on the road, and tar is then overspread or grouted into the crevices. This of course is a complete reversal of the older method of repairing macadam surfaces through the agency of water. Grouting, with its accompaniment of men with buckets of tar and sweepers, is necessarily slow, and often results in an unsatisfactory surface. If it cools too quickly to percolate into all the crevices and cranks, the tar or other compound is apt to lie on the surface in uneven blotches. The Fowler Five-in-One machine is designed to prevent this.

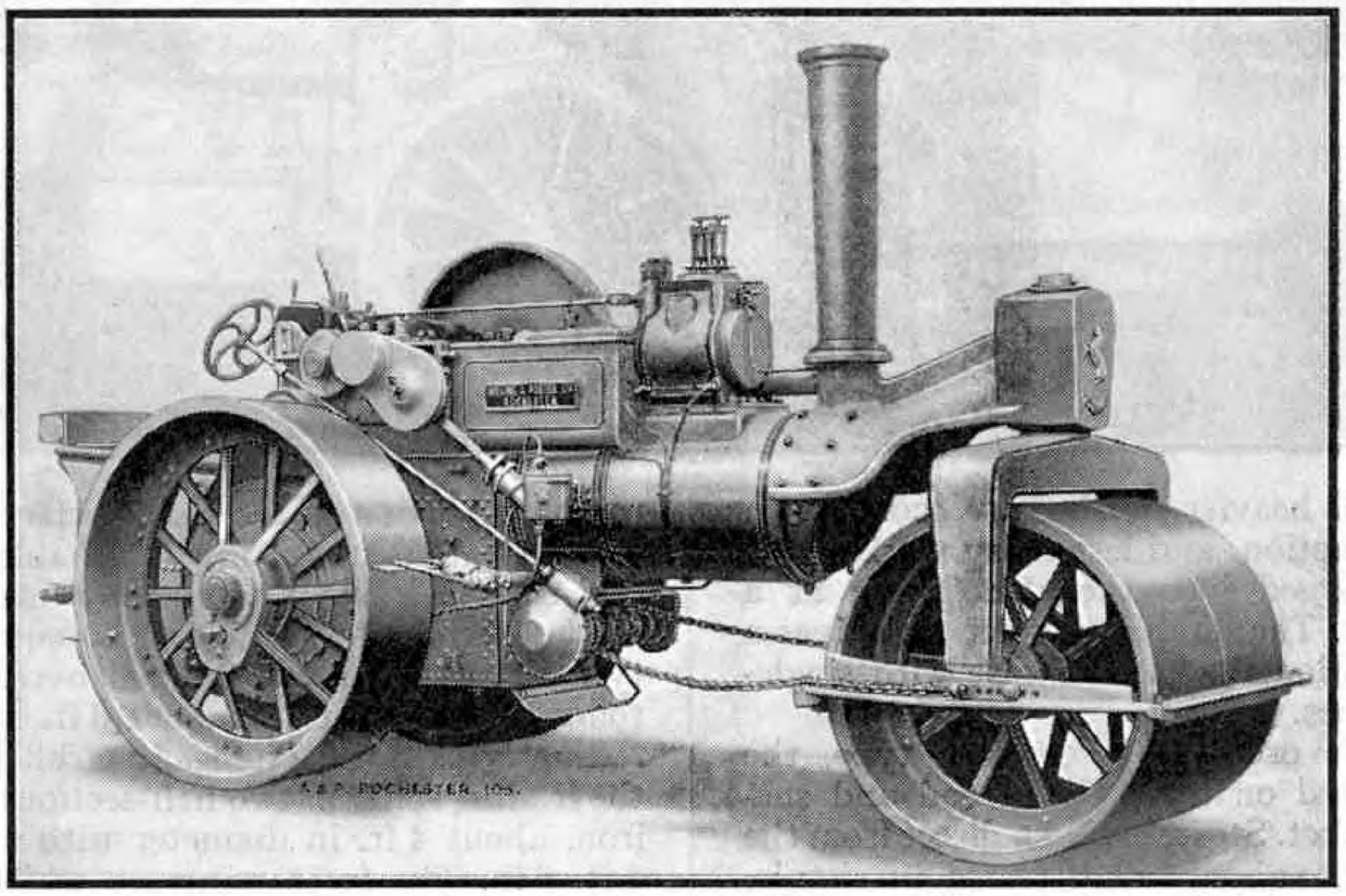
Underslung from the boiler of a standard type of steam roller are two inter-connected tanks of about 160 gallons capacity, in which tar is heated by steam coils led from the boiler. At the requisite temperature the tar is pumped to a spraying nozzle in rear of the engine, and is delivered to the road surface at a pressure of about 220 lb. per sq. in., the volume of tar delivered being adjustable. Prior to this operation the road is cleared of all surface dust by a brush attachment fitted to the roller. Immediately following the tar jets is a grit hopper or "gritter," a two-wheeled container that may hold up to 4 tons of fine stone chippings. The gritter distributes its contents over the newly-tarred road to the desired depth by means of an ingenious agitating gear, which is actuated from the road wheels of the gritter by means of eccentrics.

In addition to saving much manual labour the patent Five-in-One outfit enables the stretch of roadway under repair to be practically ready for use, with perhaps a final rolling, immediately after the passage of the roller. While it is in operation there is no need to close the highway to other vehicular traffic. Under normal conditions the area covered averages from 1,200 to 1,500 sq. yd. per hour.

This useful roller may be utilised also for repairing waterbound road surfaces, in which case it performs its own water spraying, showing an economy of about 2,000 gallons per day over the old-fashioned methods involving the use of water cart or hose pipes.

The conversion of a steam roller into an ordinary road locomotive or vice versa was formerly a long and cumbersome process involving the use of sheer legs and much manual exertion. So laborious was the process indeed that such conversions were rarely attempted, and separate and distinctive machines were built for rolling and haulage purposes respectively.

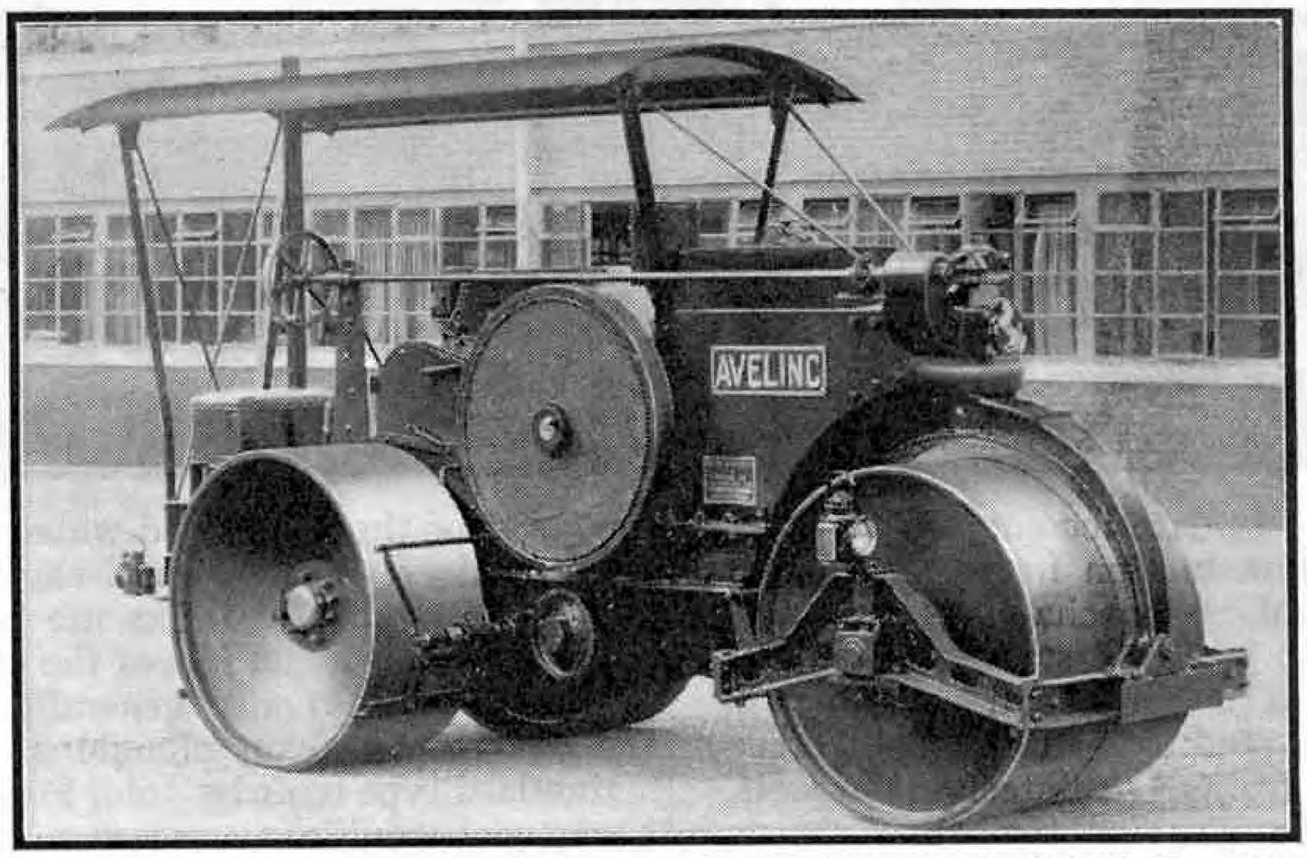
By means of an ingenious patent "change-over" device, however, a steam roller designed by John Fowler and Co. (Leeds) Ltd., can be converted into a traction engine, or vice versa, in less than two hours. The boiler is packed up at the front end, and the roller fore-carriage by means of a patent pivotal bracket is removed complete. The pivotal bracket being then unbolted at the top gravitates to its bottom position and is attached by a king pin to the traction wheels, which are moved into the position vacated by the roller. The engine is steamed slowly forward, thus relieving the packing under the boiler barrel, as the weight is transferred to the traction axle. To the latter are attached the steerage chains, and the engine is now ready for use for haulage purposes. The substitution of grooved road wheels for the rear rolling wheels is also generally necessary, but these are readily detachable. This feature of Fowler steam rollers is particularly interesting when it is recalled that the firm's earliest rollers were adapted from ploughing and traction engines.



This modern Aveling standard type single-engined steam road roller is remarkably neat and compact and shows striking changes in design to the early machine illustrated on page 507.

A recent type of steam roller calling for special mention is the quick-reverse tandem model. It is designed to meet the modern need for a roller of reasonable weight for special bituminous surfaces, tar-macadam topping and general patching work. The advantages over the standard type include easy control by one man, with a clear view to front and rear, low centre of gravity and general handiness for working quickly on hot tar where the roller must be kept operating evenly and constantly to prevent the formation of "waves." The Aveling tandem model is fitted with vertical boiler and high-speed double high-pressure engine with a radial link gear for quick reverse, controlled by a single lever. It is also fitted with steam steering gear for rapid manœuvring, and the weight can be adjusted by filling or emptying the water-ballast tanks provided.

Recent development in road rollers is exemplified by the "Aveling" Diesel roller built by Aveling-Barford Ltd. of Grantham, which firm incorporates Aveling and Porter Ltd., of Rochester and Barford and Perkins Ltd., of Peterborough, the latter being the originators of the motor roller in 1904. It is a radical departure from usual design, the motive power being provided by a single-cylinder Diesel engine using crude oil as fuel. It is made in weights of from 5 to 16 tons, and an interesting feature is that the saddle frame, gears, wheels and fork are steel. A gear-box is provided and also a quick-reverse device by means of two spring-operated clutches, one for forward and one for backward travel. Two powerful brakes, hand and foot, are provided, and it is claimed that with Diesel oil, costing £6 per ton, this type of roller can be operated at the remarkable low fuel cost of 1/– per day. In the 7-ton model a rolling width of 5 ft. 6 in. is obtained, and in developing 17 h.p. speeds of 4, 3 and 1¼ m.p.h. are attained. The total length is 15 ft. 4 in. over a wheelbase of 8 ft., and by the simple fitting of a pulley wheel the engine can be utilised for working a stone-breaking machine or for other stationary work.



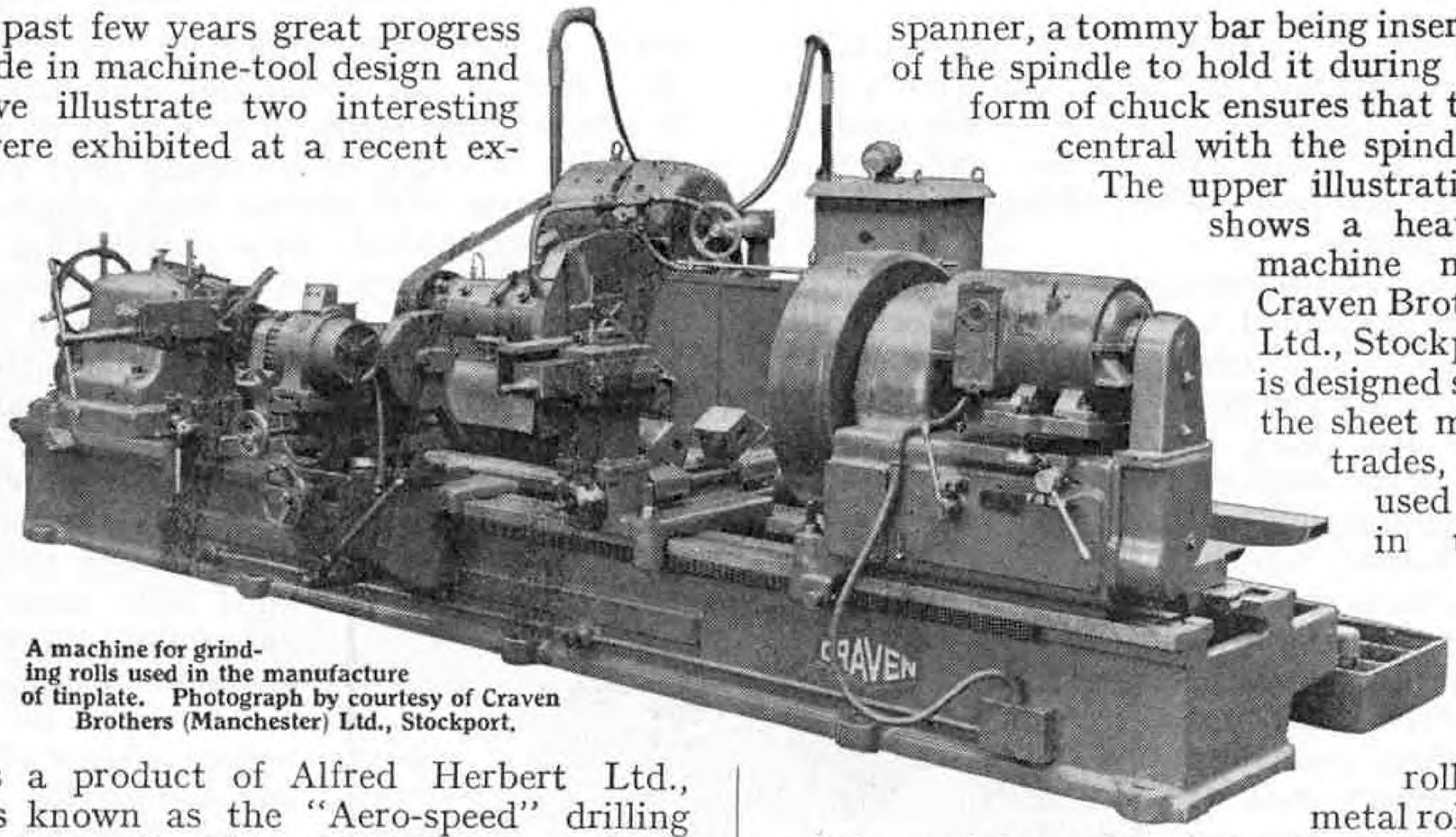
One of the latest Diesel-engined road rollers manufactured by Aveling-Barford Ltd., Grantham, to whom we are indebted for this illustration and that at the top of this page.

Another example of a modern Diesel roller is the Fowler "Precision" machine illustrated on page 506. It has a three-cylinder engine of 33 h.p. and steel plate rolls. The gear-box unit is pivoted on the rear axle and supported at the front end on a plate spring, so as to isolate frame distortion when travelling over uneven surfaces, and reduce shocks on the gears.

Interesting New Machine Tools

Fine Examples of Workshop Equipment

DURING the past few years great progress has been made in machine-tool design and on this page we illustrate two interesting machines that were exhibited at a recent exhibition at Olympia, London. The lower illustration shows a precision drilling machine suitable for drilling very small diameter holes for the extrusion of artificial silk, injector nozzles, and similar work.



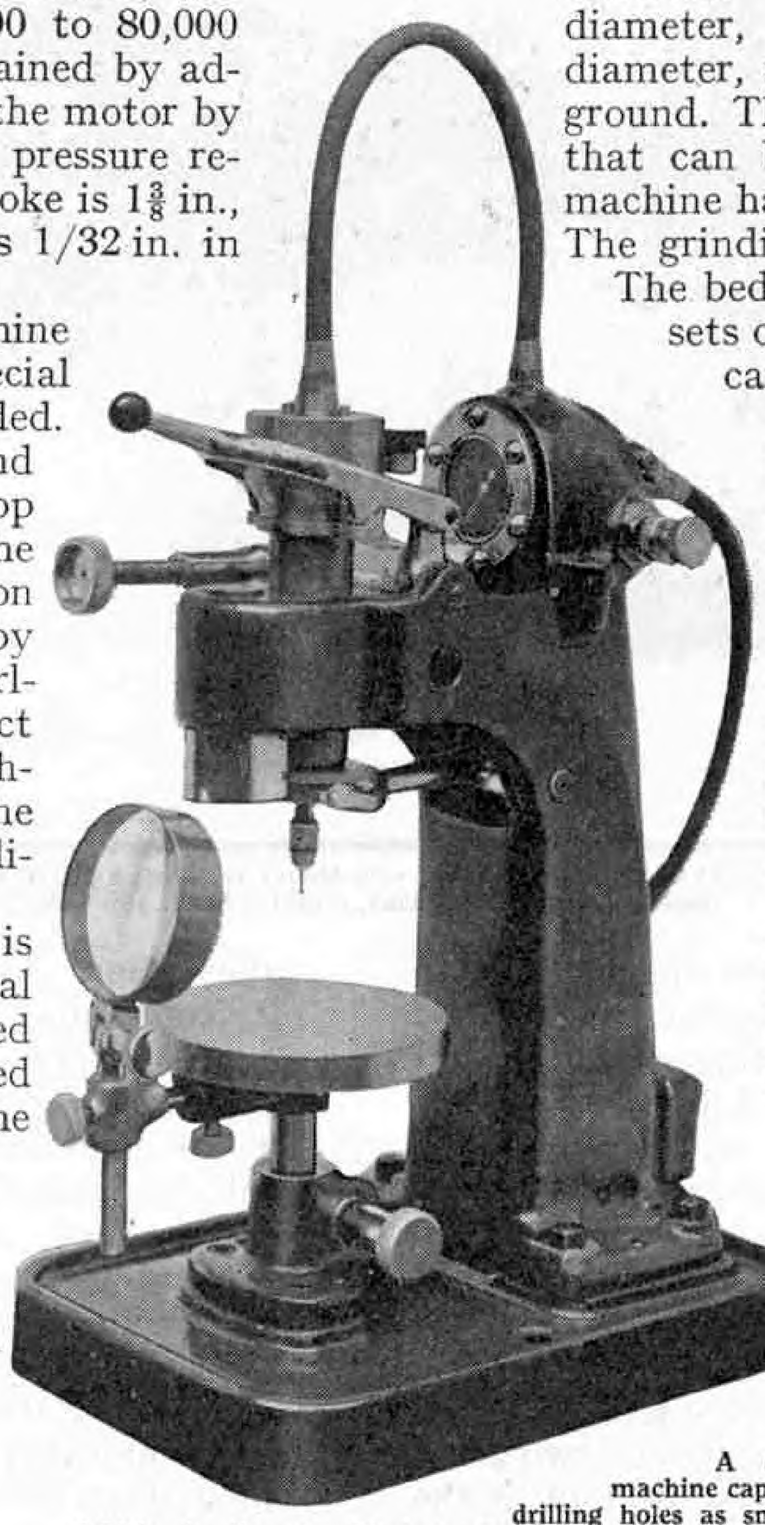
A machine for grinding rolls used in the manufacture of tinplate. Photograph by courtesy of Craven Brothers (Manchester) Ltd., Stockport.

This machine is a product of Alfred Herbert Ltd., Coventry, and is known as the "Aero-speed" drilling machine. It can be used with twist drills as small as 0.01 in. dia., and is fitted with an air motor, the normal spindle speed being from 60,000 to 80,000 r.p.m. Slower spindle speeds can be obtained by adjusting the pressure of the air supply to the motor by means of a throttle. The maximum air pressure required is 80 lb. per sq. in., the piston stroke is $1\frac{3}{8}$ in., and the largest drill that can be used is 1/32 in. in diameter.

For the small holes drilled by this machine ordinary hand feed is unsuitable, and a special fine-feed arrangement is therefore provided. The operation of a hand lever brings the end of a second lever into contact with a stop that is set to bring the drill just above the work. While the pressure is maintained on the hand lever the stop is withdrawn, by means of a fine-threaded screw with a knurled head. When the rate of feed is correct the fact is indicated by a continuous high-pitched note as the drill penetrates the metal. If the pitch of the note falls the indication is that the feed is too coarse.

When the pressure on the control lever is released, the drill is returned to its normal position by a spring-loaded lever, operated by a flange on the spindle. An illuminated dial at the top of the column indicates the drilling speed, the current for the lamp being supplied from the ordinary lighting supply through a small transformer. Attached to the table there is an adjustable magnifying glass, by means of which the operator can view the finest work with ease.

A special drill chuck of the collet type is used, the shell of the collet being in the form of a nut, which is tightened by a spanner, a tommy bar being inserted in the top end of the spindle to hold it during this process. This form of chuck ensures that the drill is exactly central with the spindle axis.



A drilling machine capable of drilling holes as small as 0.01 in. in diameter. Photograph reproduced by courtesy of Alfred Herbert Ltd., Coventry.

The upper illustration on this page shows a heavy roll grinding machine manufactured by Craven Brothers (Manchester) Ltd., Stockport. The machine is designed specially for use in the sheet metal and tinplate trades, and is of a type used to a great extent in these trades in South Wales. It is intended either for grinding new or resurfacing old rolls used in sheet metal rolling machines.

The machine will grind rolls from $4\frac{1}{2}$ in. to 34 in. in diameter when a grinding wheel 26 in. in diameter, is used. With a wheel 20 in. in diameter, rolls up to 40 in. in diameter can be ground. The maximum overall length of the rolls that can be accommodated is 10 ft., and the machine has a maximum grinding length of 7 ft. The grinding wheel is $2\frac{1}{2}$ in. wide.

The bed of the machine is provided with two sets of sliding ways, the front pair of which carry the grinding saddle, while the rear pair carry the roll revolving headstock and tailstock, with a special support for the roll in between them. The headstock, tailstock and roll support are traversed along the bed by rack and pinion gear, and the headstock is driven by a $7\frac{1}{2}$ h.p. motor, transmission being through speed change gears. The faceplate rotates about a dead centre, and the tailstock also is fitted with a dead centre.

The saddle on which the grinding wheel is mounted is traversed along the bed by rack and pinion, the motive power being provided by a $4\frac{1}{2}$ h.p. electric motor, which acts through an eight-speed gear-box. Fine and coarse feed adjustments are provided for the grinding wheel, and all the controls are grouped conveniently within the operator's reach, so that he can manipulate any one of them without changing his position near the grinding wheel. Rolls can be ground either parallel or with concave or convex cambers as desired.

The Yosemite National Park

A Wonderland of Peaks and Waterfalls

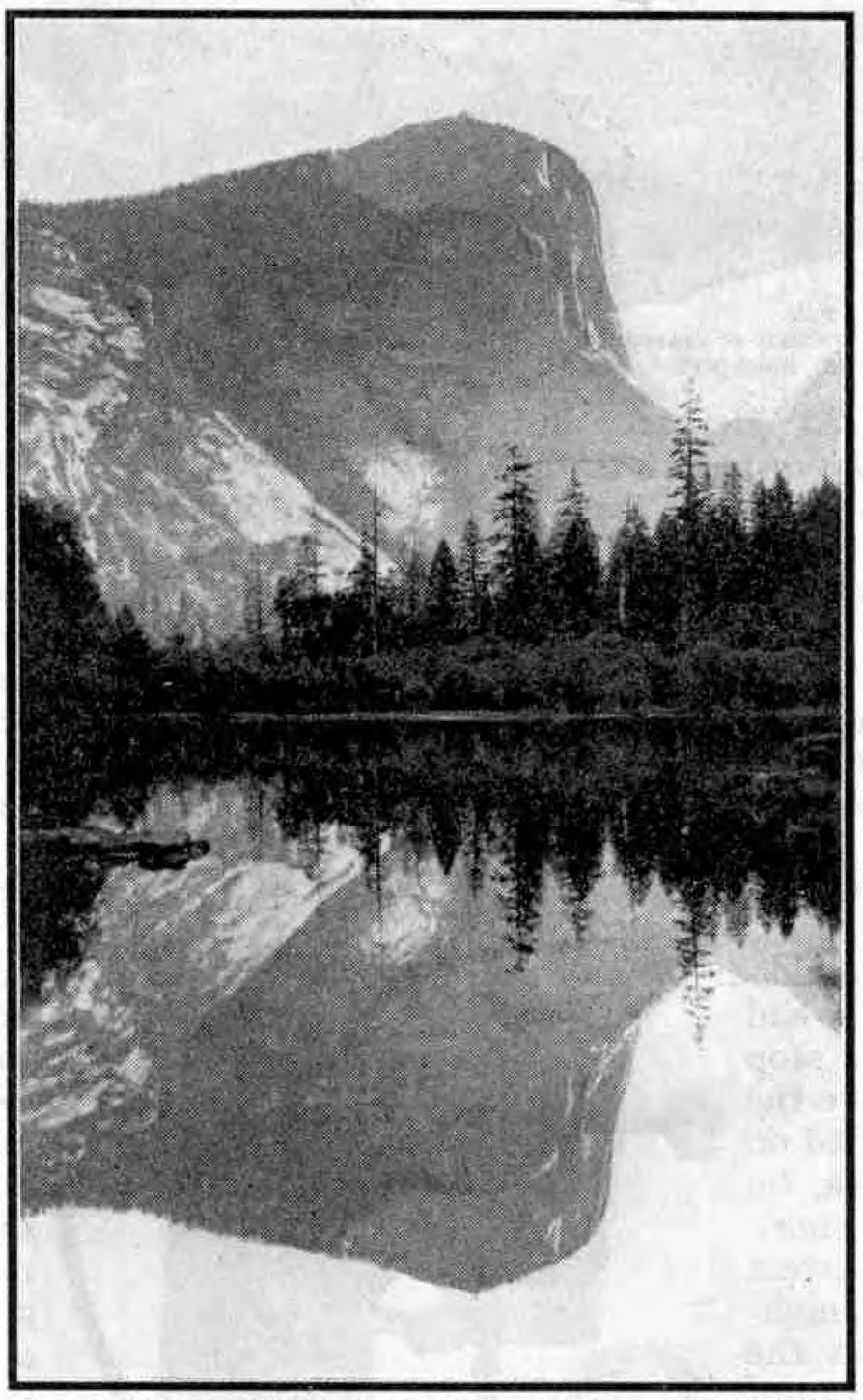
By D. L. Joslyn

FOR some time we had planned to pay an extended visit to the Yosemite National Park, which covers an area of some 1,500 square miles and includes the famous Yosemite Valley. Our opportunity came, and in due course we set off on the four-and-a-half-hour ride from Sacramento to Yosemite.

Arriving at El Portal, the entrance to the Yosemite National Park, we descended a few hundred feet and then climbed up again and around a bend in the road to get our first view of the Yosemite Valley in all its splendour. In the distance were snowcapped mountains, and right under us, it seemed, was the narrow winding basin of meadow, gorge and shining river, shut in by granite walls from 2,000 ft. to 5,000 ft. high—walls with immense turrets of sheer rock, and so vertical and perfect that at very few places indeed can an expert cragman climb out of the valley. At Arch Rock Ranger's Station we were stopped while the number of our automobile was taken, as well as particulars of the make, the year, the model, the licence number and all that. Then we were asked if we had any dogs, cats or firearms with us! On giving an assurance that we had none of these things, we were issued a licence to operate a motor vehicle in the National Park, and paid our two-dollar fee and went on our way.

We soon passed under Arch Rock, a huge boulder lying over against another boulder to form an arch over the road; and then came to Cascade Falls, one of the smaller falls of Yosemite. Soon the canyon opened out a little, and we were alongside the Merced River as it flowed along by a wide open meadow dotted with a large variety of wild flowers. Across the meadow we could see Bridal Veil Falls tumbling over the cliff and coming down to swell the river. A little farther on were the Three Graces, known also as the Cathedral Rocks, which rise 2,592 ft. above the floor of the valley. On our left there rose a huge granite cliff down which tumbled the Ribbon Falls in a sheer drop of 1,612 ft. Farther along the road El Capitan raised his granite head to a height of 3,604 ft. above the valley.

We rode up the valley and over a bridge to Bridal Veil Falls, and parked our car in the forest between two giant pine trees. Then we climbed the trail to the foot of the falls, and sat and watched the waters and the changing lights as they came and went. It was quite misty up there and we got pretty wet, but that did not matter. It was a grand sight. The Fall is an unbroken ribbon of water softened by a delicate mist that half hides it; a white strip of fluttering foam, which the wind sways like a silken ribbon. It is spanned by a rainbow when the sun shines on it, and at some points the thin glass-like sheet reveals every hue of the wall behind it. Before reaching the bottom it seems to be completely transformed to spray.

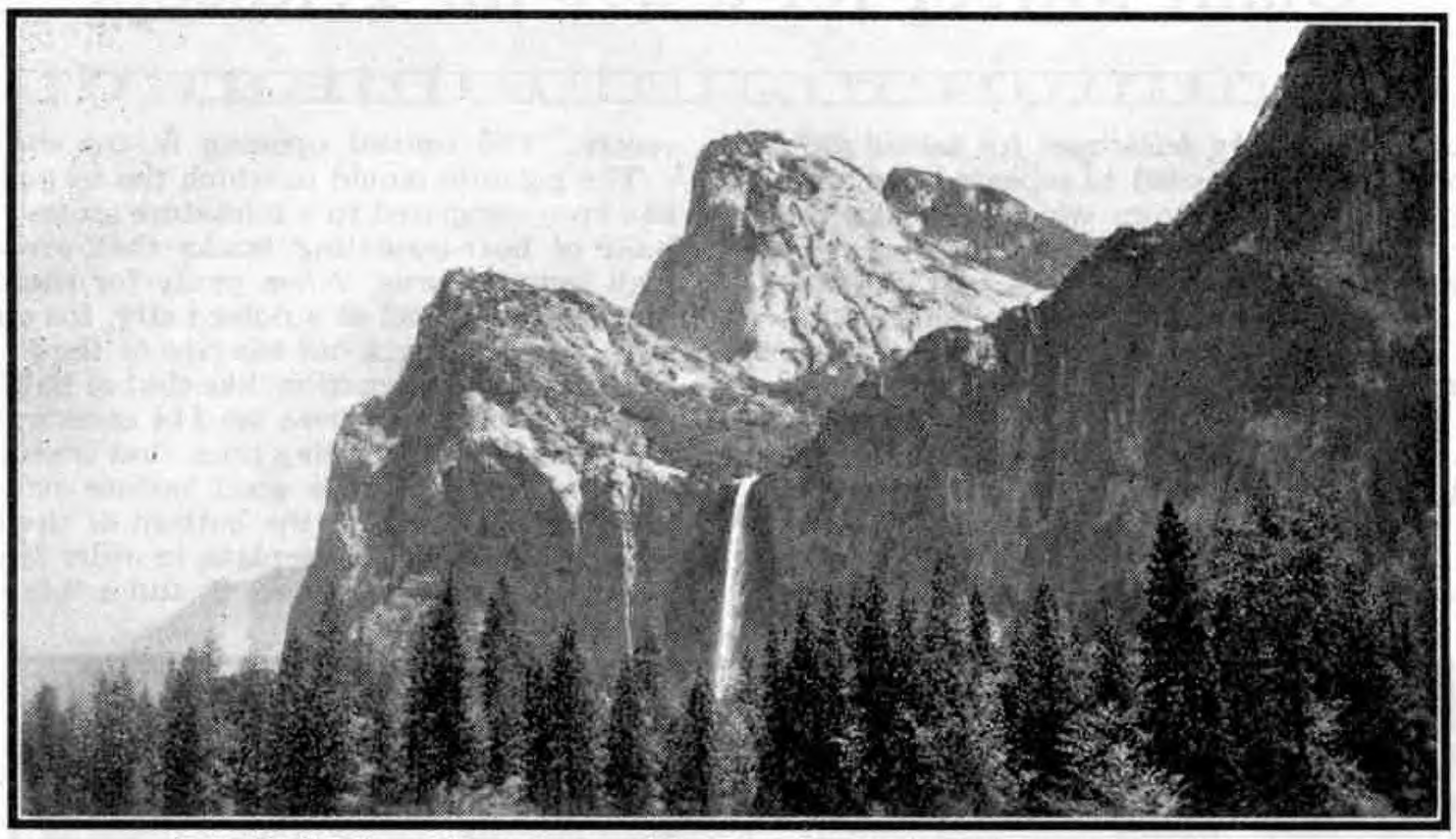


Mirror Lake, Yosemite Valley, with Mount Watkins, 4,000 ft. higher than the surface of the lake, reflected in the still waters.

Farther on we saw the Yosemite Falls tumbling over the top and could hear the roar of the waters even though we were a good mile away, and with our automobile travelling at 50 miles an hour. Taking a side road we descended to the place where the waters entered the Merced River, and leaving the car in the shade of a friendly redwood giant walked up the trail to the base of the lower fall. The waters were coming down with a roar that made conversation out of the question; we had to shout directly into one another's ear for any words to be heard at all. The spray was flying like a cloud and we got soaked, but I would not have missed it for anything. Returning to our car we rode on until we came in sight of the Cathedral Spires, two granite rocks that lift their heads 2,154 ft. above the valley, and look for all the world like the spires of some vast cathedral. A little farther on was Sentinel Rock, a slender spire rising for nearly 4,000 ft.

So we came at last to Camp Curry, under the lea of Glacier Point, a granite wall rising almost vertically 3,254 ft. above the valley floor. After securing a redwood cabin, having a nice cold shower, and resting for an hour or two, we set out for Happy Isles. On arriving there we parked our car in the shade of the redwoods and started up the trail for the two-and-a-half-mile walk to Vernal Falls. The trail rose rather more than 1,000 ft. to the mile, was very crooked, and at every turn showed us new and beautiful wonders. As we ascended we left the river, but caught views of it from time to time as it rushed madly along among the rocks far below and leaped for joy in many foaming cascades. Across the canyon, far up on the other side, we saw the Falls of the Illiloutte, which drop 370 ft. sheer and then form a number of cascades as the waters seek the river. On we went, and

presently upstream we saw the Vernal Falls, which carry the full waters of the Merced River. As one stands on the rocks above the Falls the waters approaching in a deep wide stream seem to creep softly and slowly, as if in hesitation. Reaching the edge they rush eagerly over the gloomy brown rocks, and then leap headlong down 317 ft., roaring like a miniature Niagara. At the base of the Falls, when the afternoon sun strikes the basin, appears the round rainbow that so many come here specially to see. It comes and goes. First one sees two rainbows, perfect arcs of circles; then, as one watches, these two join ends to form a complete circle. It is a marvellous sight. We sat entranced by the beauty of the scene until we were warned by the forest ranger that night would fall suddenly, that it would get quite cold up there, and that we had best get down the trail before it became dark. So we descended to our car and back to camp.



Bridal Veil Falls and the peaks named the Three Graces, viewed from across the Valley.

In the morning we were up early to have a quick breakfast and then away to see the sun rise on Mirror Lake. It was a still, cold morning, and the lake had not a ruffle on it. The lake is shut in by high peaks, and while the sun was shining at Camp Curry when we left, it was only just getting light at Mirror Lake. Soon a streak of sun hit the top of Mount Watkins, 4,000 ft. above the lake. Then the top of the mountain became bathed in sunlight, and as we stood there, nearly a thousand of us, all as quiet as death, the sun came over the top of Cloud Rest and hit the tops of the tall trees to our left. It was a sight worth going many miles to see. Cloud Rest is the highest of the many domes and peaks in the valley. It rises 5,964 ft. above the floor of the valley, and as this is 4,000 ft. above sea level, the peak is therefore over 9,000 ft. high.

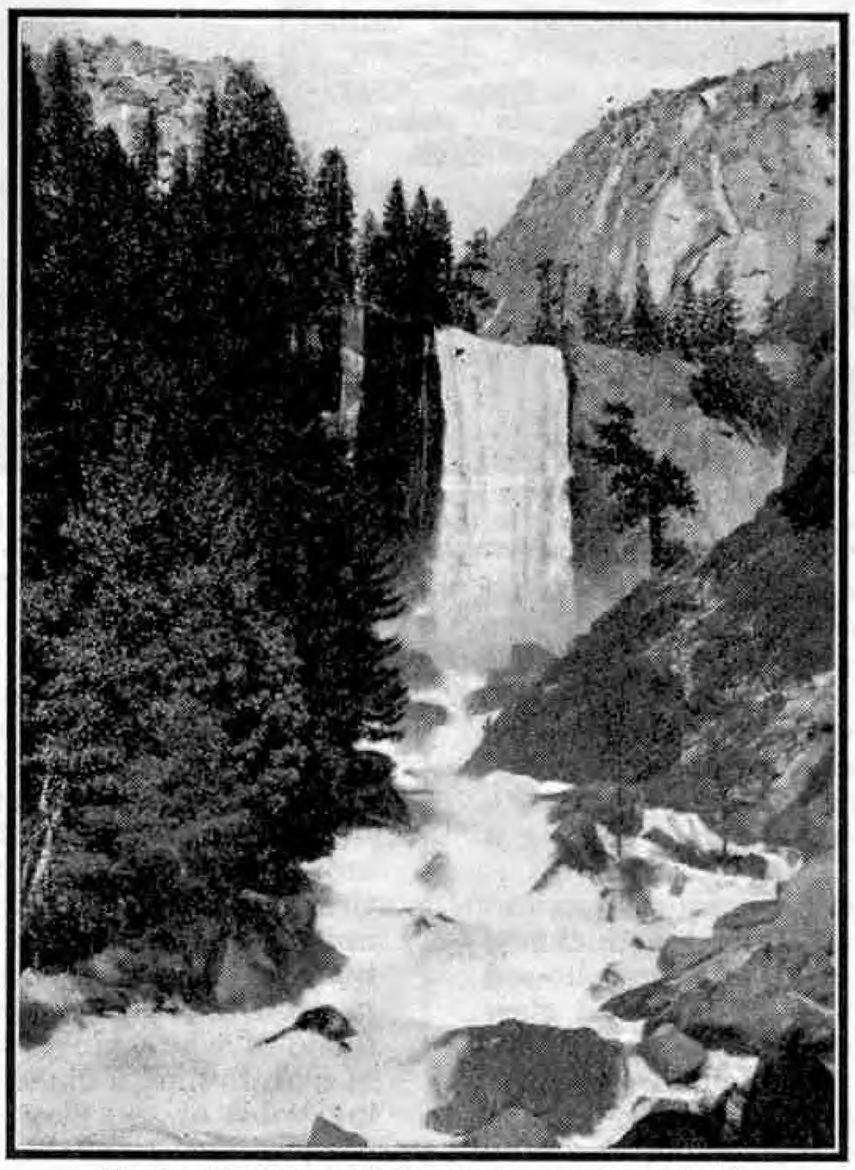
Mirror Lake is the very soul of transparency. It reflects grass, trees, mountains, rocks and sky with such perfect and startling vividness that one cannot believe them to be images and shadows. One fancies the world to be turned upside-down, and indeed some shrink back from the edge of the lake lest they should fall over into the inverted dome of blue sky.

There were many other places that we intended to see, but unfortunately we were obliged to return to Sacramento. Some time we intend to return and to see the famous Nevada Falls, which many people consider to be the finest in the world. Here the full flood of the Merced drops down over 600 ft. sheer.

* * * *

The Yosemite National Park is an immense region, on the western or Californian slope of the Sierra Nevada, about 150 miles east of San Francisco, that is preserved in its natural condition under the control of the United States Government. The central feature of the Park is the Yosemite Valley itself, the floor of which is about 4,000 ft. above sea level. The Valley is a gigantic gorge carved out by the action of glaciers, traces of which can readily be seen on the surrounding hills, and has long been famous for the beauty and height of the many waterfalls in the courses of the streams flowing through it.

The Park is one of the remaining homes of the sequoia, the giant tree that in prehistoric times flourished in many parts of the world, but to-day is found only in a few groves on the mountain slopes of Eastern California. The sequoias in the Yosemite National Park are of immense size, some of them towering to a height of more than 200 ft. and possessing trunks with girths of nearly 100 ft. at their bases. The ages of these trees are even more remarkable than their size, however, for many of them are known to be about 2,000 years old, and a few growing in favourable situations have reached the immense age of 3,000 years. The oldest sequoias grow in smaller National Parks on the slopes of the Sierra Nevada, and in one of them is a stump with an annual growth ring that was formed in 1305 B.C. This ring is about an inch from the centre of the stump, and the tree that recently grew there must have begun life about 1311 B.C., to attain the great age of 3,200 years before it was cut down.



The beautiful Vernal Falls, leaping headlong 317 ft.

The Yosemite National Park is only one of 21 great tracts with a total area of 12,118 square miles that have been preserved in the United States. The largest is Yellowstone Park, which covers 3,348 square miles, and is remarkable for its hot springs and geysers as well as its scenic grandeur. Another famous National Park encloses 56 miles of Grand Canyon, an immense gash with walls that in places are more than a mile in depth.

Casting the World's Largest Glass Disc

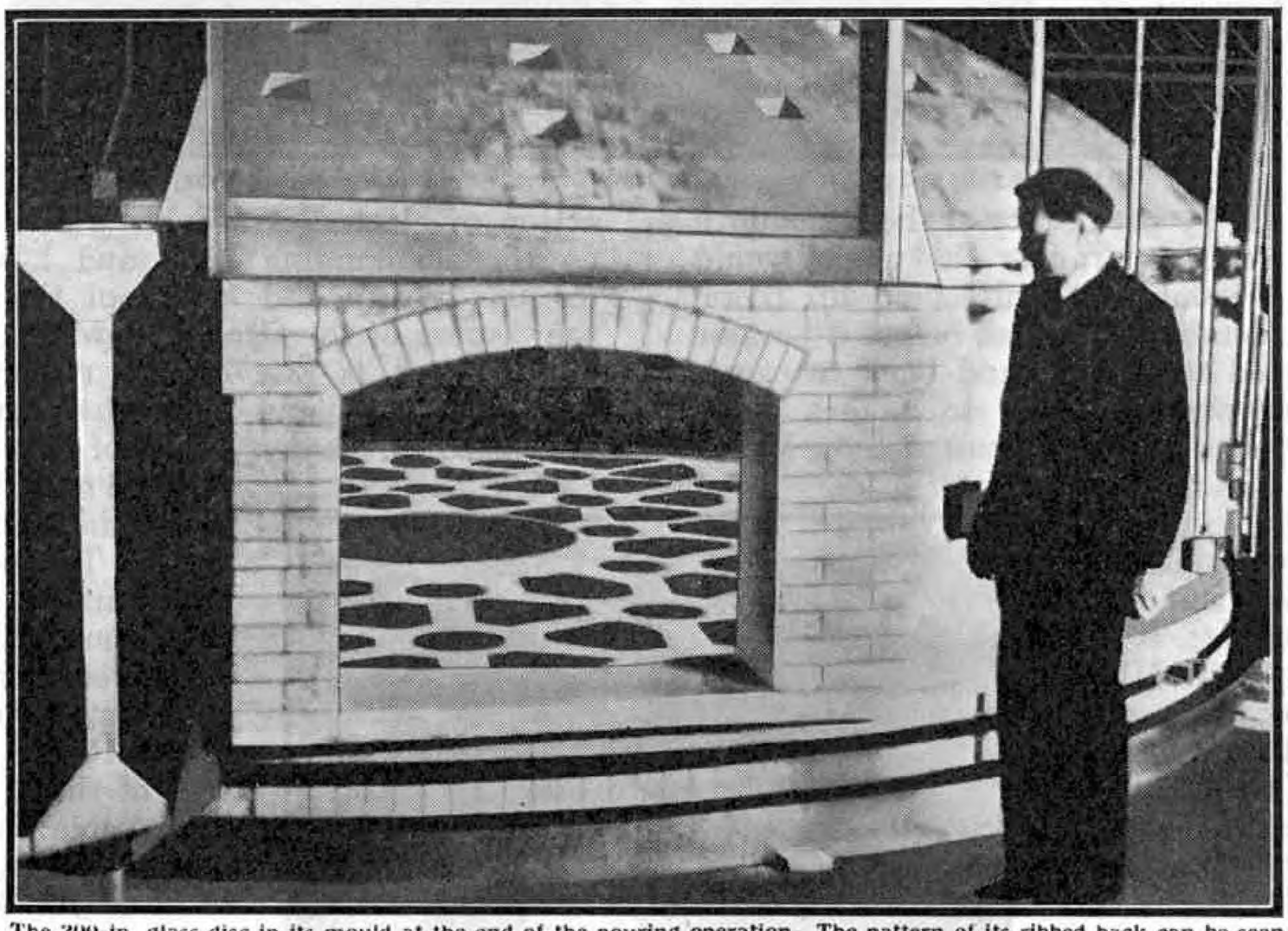
Giant Mirror for a 200-in. Telescope

THE construction of larger reflecting telescopes for installation in the world's great observatories has led to repeated demands from astronomers for larger glass discs from which to make the immense concave mirrors on which the light gathering powers of these instruments depend. The diameters of discs cast for this purpose have been increased successively to 60 in., 72 in. and 100 in., and all previous records were eclipsed in March of last year, when a disc 200 in., or nearly 17 ft. in diameter was made at the Corning Glass Works, New York State. The total weight of this disc when cast was about 18 tons, and it was intended that it should be ground, polished and silvered to form the concave mirror of the 200-in. telescope that is to be erected at an observatory on Mount Palomar, in southern California. Unfortunately, a slight mishap occurred during its preparation. This was not sufficiently serious to reduce the value of the disc for its special purpose, but the Corning Glass Works were determined to produce an absolutely perfect piece of glass for the giant telescope, and a second disc of the same size was cast last December. This time every operation proceeded without the slightest hitch, and the completed disc is now cooling slowly, a process that will require nearly a year to complete.

More than two years were spent in preparatory work, which included the experimental casting of discs 30 in., 60 in. and finally 120 in. in diameter, before the preparation of the first 200-in. disc was attempted in March, 1934. In considering plans for this gigantic task, the first thing to be decided was the kind of glass to be used; and eventually what is called a boro-silicate glass was chosen. One reason for this choice was that a piece of this glass expands on heating to only a quarter of the extent to which a piece of ordinary window glass of equal size would expand when its temperature was raised through the same range. It is a great advantage to use a glass that shows little variation in size with changes in temperature, both in dealing with the problems encountered during casting and also in designing a mount for the completed mirror.

The form in which the glass was to be cast also required serious consideration. Discs for telescope mirrors usually have a thickness equal to 1/6th of their diameter, but if this rule had been followed in the disc for the mirror of the 200-in. telescope, the solid glass casting would have weighed more than 40 tons. Fortunately it was found possible to reduce the weight to less than half by casting a disc with a ribbed back, the ribs being so designed that there was no loss in structural strength. This method was tested with the 120-in. disc made during preliminary work, and with the 200-in. disc already completed. The backs of these discs show a geometrical pattern of rings from each of which radiate six ribs; and the disc cast in December of last year will present a similar appearance when it is turned out of its mould. Its actual diameter then will be 201 in. and its weight 18 tons. The ribs in its centre will be 16 in. deep and those at the rim 19.83 in. deep. As the total thickness of the mirror will be 24.83 in., the actual thickness of the solid slab of glass above the ribs will be 5 in. at the rim and nearly 9 in. in the centre. The central opening in the disc is 40 in. in diameter.

The gigantic mould in which the second 200-in. disc was shaped has been compared to a miniature circus ring. It is circular, and is built of heat-insulating bricks that are capable of withstanding high temperatures. When ready for the glass to be poured in, it resembled a model of a domed city, for on its base stood the cores that were to mark out the ribs of the back of the disc, and these were in regular formation, like that of buildings in carefully planned streets. Altogether there are 114 cores in the mould, and they are made of a heat-insulating brick that is very slightly porous, a factor that helps to ensure a good surface structure for the glass. The cores are anchored to the bottom of the mould by means of rods passing through the baseplate, in order to prevent them from rising when the glass was poured in; and a thin wash of silicate flour was applied to their surfaces before pouring began to prevent the glass from sticking to them when cold. It may be added that the trouble arising during the casting of the first 200-in. disc was due to the cores, for some of them floated upward while molten glass was being poured into the mould.



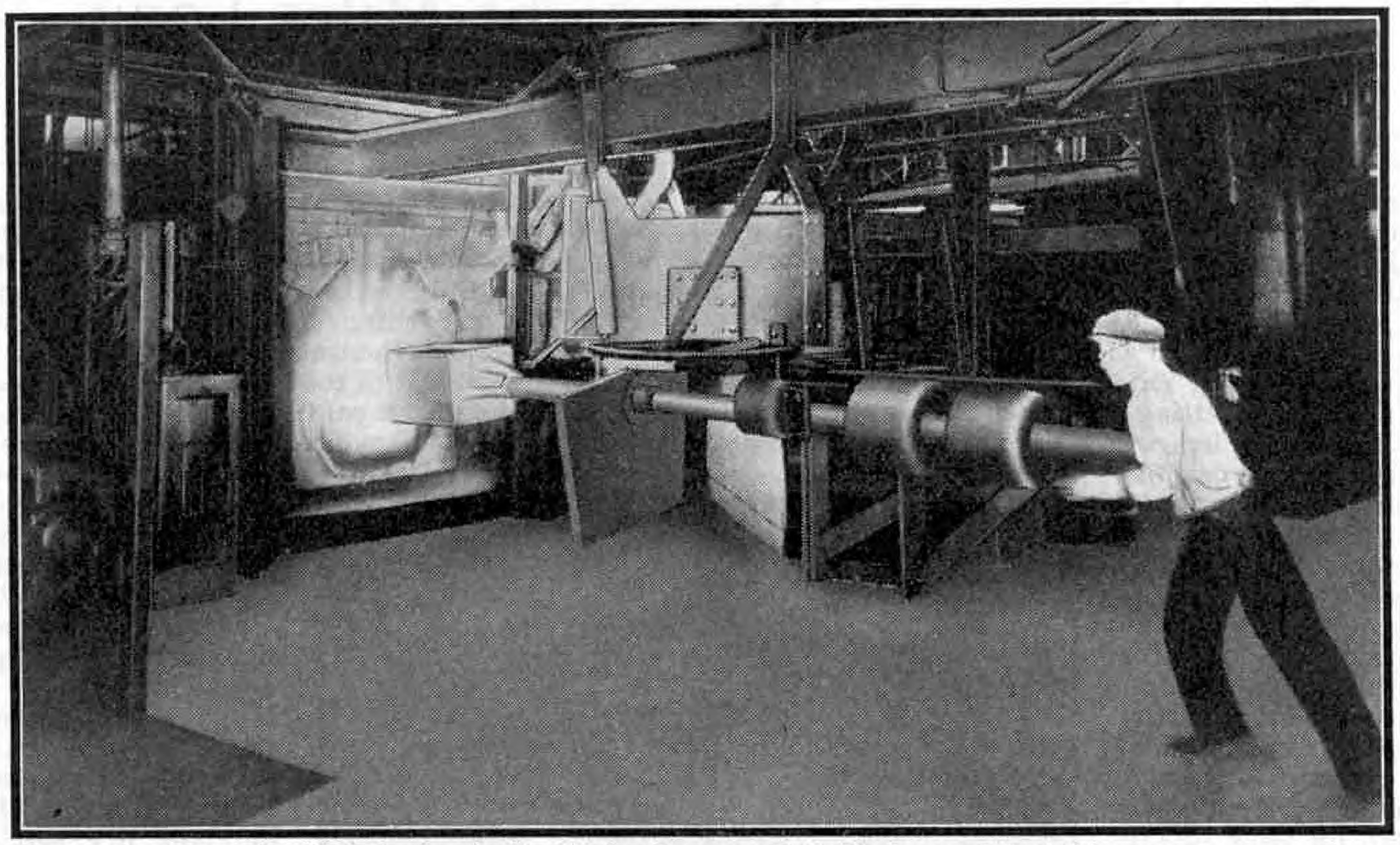
The 200-in. glass disc in its mould at the end of the pouring operation. The pattern of its ribbed back can be seen through the molten glass, and the 40-in. opening in the centre also is visible. The illustrations to this article are reproduced by courtesy of the Corning Glass Works, Corning, New York.

A gigantic furnace in which the temperature was 2,800 deg. F. was used for melting the glass and making it ready for pouring. This is heated by gas, and has a high arched roof of refractory brick. It was heated for 10 days before any materials were delivered into it, and the charge was then added at the rate of 400 lb. per hour day and night until about 40 tons of raw material had been introduced. This gave the proper "melt," which was then heated for a further period of six days in order to free it from gas bubbles and generally to bring it into the most suitable condition for pouring. The upper illustration on the next page shows this charging operation in progress. The raw materials to be introduced were carried in the bowl of a gigantic ladle suspended from an overhead runway and manipulated by means of a long handle.

When the glass had been melted, and was ready for pouring, the mould was placed in position to receive the white hot liquid. As the pouring would occupy a considerable time, and the glass could not be allowed to cool during the operation, a heating cover was built for the mould. In shape this cover suggests an Eskimo igloo, or snow house, for its low vertical sides are crowned by a low dome made of white firebrick. Inside the cover are gas burners capable of maintaining a higher temperature under its dome than the melting point of the glass, and three doors spaced at equal intervals are provided to enable the liquid to be introduced.

Ingenious arrangements were made for handling the mould and the dome that covered it during pouring operations, the dome actually being suspended from the steel framework of the building. The mould was constructed on a carriage running on rails, the circular base plate on which it was built being supported by four screws, each 4 ft. in length and 4in. in diameter. On this carriage the mould was run under the dome and raised by means of the four screws until the two parts fitted together so tightly as to form in effect a beehive oven.

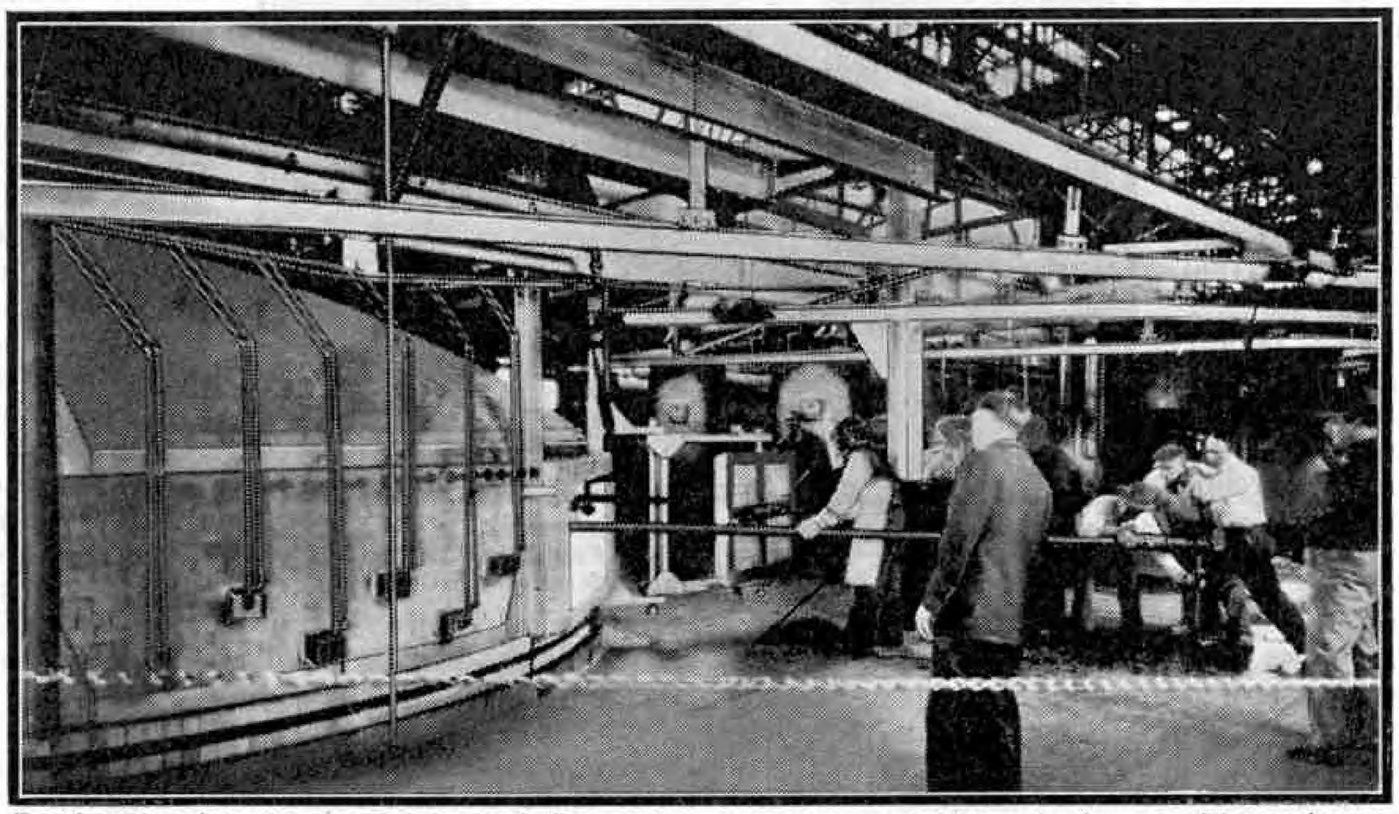
All was now ready for pouring to begin. The molten glass was transported in the bowl of a ladle suspended from an overhead runway, and three lines of these runways led from the melting furnace to the mould and its beehive cover. Three men under the direction of the chief ladler were required for this operation, and the foremost workman was protected from the heat and glare by a mask and asbestos gloves and apron. The ladle was first dipped in water in order to cool it, and was then brought into an inverted position and pushed through the doorways of the furnace. There it was filled with molten glass by dipping it into the liquid and rotating it, and when full it was steadily withdrawn and its contents were transferred to the mould. On the way from the furnace to the mould the weight of the ladle was taken by the runways, and in order to reduce the strain of handling, provision was made for sliding it through the suspension mechanism in order to balance it, whatever the weight of material carried in its bowl.



Charging the furnace in which the glass for the 200-in. disc was melted. The furnace is heated by gas and a temperature of 2,800 deg. F. was maintained in it.

Three of these ladles were employed, and each was capable of holding about 750 lb. of glass. The transfer of the white-hot "melt" was continued for about 10 hours, and 104 ladle loads were required to fill the mould. The whole of the glass lifted out of the furnace did not reach this destination, for part of each ladleful adhered to the rim and had to be broken away by means of an iron bar. In addition, the rim of the ladle was sprayed with water from a tank carried on the back of one of the workmen, and this gave rise to a ladle skin of about 300 lb. of glass, which adhered to the metal and afterwards was broken away and remelted as required. Altogether about 75,000 lb. of glass was drawn from the furnace, but only 40,000 lb. was poured into the mould.

When sufficient glass had entered the mould the temperature under the dome was increased to about 2,400 deg. F. for several hours, giving the necessary opportunity for the escape of bubbles formed during pouring operations; and the burners were then turned out and the mould with its contents allowed to cool to a dull red heat, representing a temperature of 1,200 deg. F. The mould then was lowered from the pouring position under the dome by means of its large supporting screws, and the carriage on which it rested was moved horizontally to a position beneath a second cover, known as the annealer. There it was raised until it was completely covered, an insulating seal between the mould and the annealer combining the two sections into one unit. The transfer from the pouring beehive to the annealer was completed in about an hour.



Pouring glass into the mould from the ladle in which it was transported from the furnace. The workman manipulating the ladle was protected from the intense heat by a face shield and an asbestos apron.

The annealer used in making the 200-in. disc resembles the pouring cover in shape, and it also is suspended from the framework of the building. Its heat insulating walls are 18 in. in thickness, and on their inner surfaces and under the beehive roof there are electric heating elements operating on a low voltage. There are similar elements in the base of the mould, and altogether 304 of these elements are in use. They contain 4,864 ft., or a little short of a mile, of nichrome ribbon $\frac{3}{4}$ in. in width, and the flow of the current is controlled by means of 10 automatic temperature regulators. Thus the glass that eventually will form the disc is completely surrounded by heating units, and can be kept at any desired temperature.

Cooling is expected to take 10 months. The temperature was kept constant for the first three months, and since then it has been lowered steadily at the rate of nearly 2 deg. F. a day, a process that will be continued until room temperature is reached. The purpose of this leisurely cooling is to avoid strains that otherwise would be set up in the glass as it solidified and contracted.

When the cooling process has been completed, the disc and its mould will be lowered from the annealer, the steel rim will be taken off, and the disc will be free from the material that has given it its shape. The next step will be to build around it a heavy timber framework by means of which it can be lifted to stand on its edge in order that the cores may be removed, leaving the ribbed disc itself free of all foreign material. Careful optical examination for strains will then be carried out, and it will not be known whether the long and costly operations have been successful or not until this has been completed.

If the tests give satisfactory results, the disc will be despatched to California. Transporting the 18-ton mass of glass across the American continent will not be an easy task. If it is sent all the way by rail it will be carried on a well wagon, but it may be taken in this manner only to the nearest convenient seaport, to be shipped to its destination by way of the Panama Canal. Grinding and polishing will then begin. This cannot be accomplished quickly, for the glass becomes heated when it is ground, and so little of the work can be done each day that no less than three years will be required for this part of the preparation of the mirror, in spite of the fact that the temperature of the workshops in which it will be carried out will be carefully controlled. Successively finer abrasives will be used in the later stages of the process in order to produce a smooth polished surface, and this will be given the concave form that will enable it to concentrate the light of the stars at the focal point of the giant telescope in which it is to be mounted. Finally the mirror will be coated either with silver or with aluminium in order to give it the desired reflecting power. Mirrors can now be coated with aluminium by placing them in vacuum chambers above electrically heated crucibles containing the metal. Aluminium is more effective than silver in reflecting light that is of special value in photographic work, and for that reason the mirror of the 100-in. telescope at Mount Wilson, California, has been re-coated with this metal.

Bridging San Francisco Bay

Steel Highway Over Eight Miles Long

By Harold J. Shepstone, F.R.G.S.

ACROSS the waters of San Francisco Bay the engineer is now throwing a mighty steel pathway, the construction of which is the greatest of all bridge-building feats yet attempted. Some idea of the size of the undertaking may be gained from the fact that the bridge will have a length of 8¼ miles, 4½ miles of which are over deep water. Its cost will be £15,880,000, or nearly four times that of the Sydney Harbour Bridge. The scheme is unique for the many records that it is setting up. Chief among these are the great depths of some of the piers, which penetrate 220 ft. below the waterline; and the bold and original manner in which their foundations have been secured.

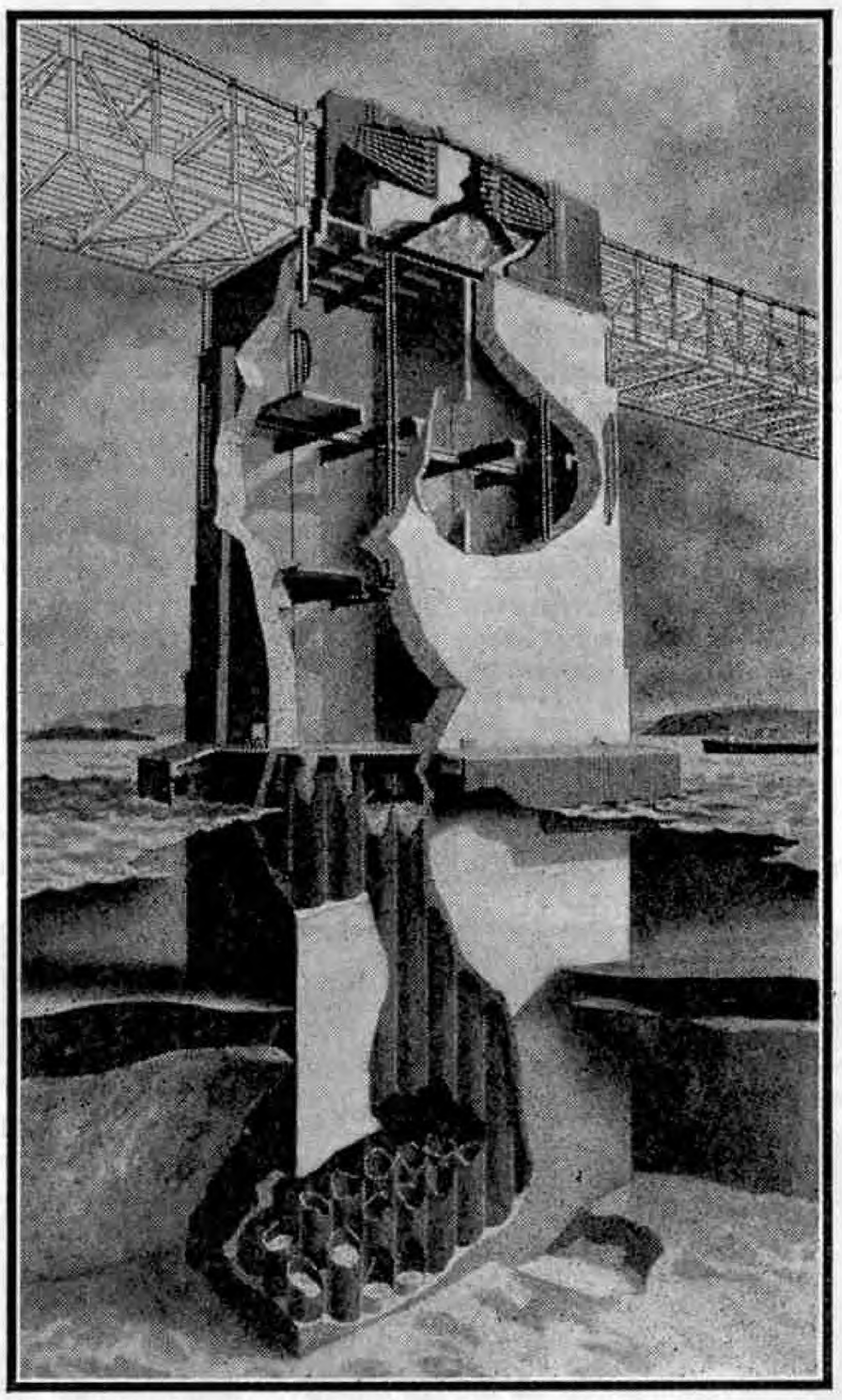
The need for this giant bridge has arisen from the peculiar situation of San Francisco. The city occupies the tip of a narrow peninsula and is unable to expand. With water on three sides, its land exit has always been a bottle-neck, and it finds itself cramped and to a certain extent cut off from the rest of the world. Its inhabitants certainly can go anywhere by water, for ferry steamers cross to Oakland, Berkeley and Alameda, the rapidly growing cities on the opposite side of the Bay, and larger vessels depart for Hawaii, the South Sea Islands, Australia, New Zealand, China and Japan, and indeed all parts of the world. But by land they can only go south, whereas the main lines of their continental traffic run east. The great new bridge will free them from this restraint by providing a new direct rail and road route eastward.

The citizens of San Francisco have always been proud of their Bay, with its 400 square miles of sheltered water in which the navies of the whole world could be accommodated, and of the efficient ferry services that cross it. During the rush periods there is a passenger ferry boat every quarter of an hour between San Francisco and Oakland, as well as special ferries carrying motor cars, vehicles, and complete trains; and last year 45,000,000 people and 5,000,000 motor cars made use of the service. Many thousands of the business people of San Francisco live in these over-the-water cities, crossing the Bay by ferry steamer morning and evening.

Until recently it was considered impossible to connect San Francisco with the other cities of the Bay by a bridge, owing to the great depth of the water. The rapid advance in engineering science during the past 10 years seemed to show that the difficulties could be surmounted, however, and this has proved to be the case. The foundations of the bridge are completed, and the underwater work in connection with its construction is finished. All that remains to be done is to erect the steel superstructure, a task that is expected to be completed within the next 18 months.

Out in the Bay, some two miles from San Francisco, is an island named Yarba Buena, or Goats' Island, an irregular outcrop of sandstone rising 340 ft. above the water, and about 3,000 ft. wide, that is used by the Government as a naval station. The engineers have seized upon this island as a kind of stepping stone. The channel separating it from San Francisco will be crossed by a double-decked bridge of the suspension type, consisting of two main spans each 2,310 ft. long, and four side spans each of 1,160 ft. This immense structure will be supported by four steel piers towering more than 500 ft. above the water, and three great concrete anchorages; and it will clear the water by 180 ft. to 214 ft., a height more than sufficient to allow the largest vessels to pass beneath.

Traffic on the bridge will cross the island through a tunnel 80 ft. wide, 60 ft. high, and 540 ft. in length, lined with steel and concrete, and the largest bored tunnel in the world. From this point the crossing will make a distinct curve before running on to the section of the bridge that spans the waterway between Goats' Island and Oakland on the eastern side of the bay. One part of this section of the crossing will consist of a cantilever span 1,400 ft. long, standing 185 ft. above water. This will not be the longest cantilever span in the world, but it will be exceeded in length only by those of the Quebec and Forth Bridges, which are 1,800 ft. and 1,710 ft. in length respectively.



Sketch showing the construction of the central anchorage, the greatest engineering wonder of the San Francisco-Oakland Bridge. Its summit is 540 ft. above the rock on which it rests.

The most difficult part of the whole undertaking was securing the foundations of the piers, particularly those in deep water. Of the 51 piers in the great bridge, seven are on dry land and 44 in the water. The foundations of three of these 44 underwater piers rest on great beds of concrete that were formed by dumping dry concrete from specially-designed buckets into steel cofferdams resting on the floor of the Bay. The foundations of 34 of the other piers are built on fir piles, 80 ft. long, driven into the soft bottom of the Bay; and the number of these piles required for each pier varied from 300 to 625. Three other piers consist of cellular concrete bases formed within great caissons, and the remaining four are entirely original in design, and for that reason have attracted the attention of engineers all over the world.

An account of the erection of the great central anchorage will give an idea of the novel and daring methods by which foundations for some of these colossal piers were obtained. This anchorage is regarded as the greatest engineering wonder of the bridge. It is half way between San Francisco and Goats' Island, and when the structure is completed will be called upon to take the strain of the immense cables supporting the two spans of the double suspension bridge across this part of the Bay.

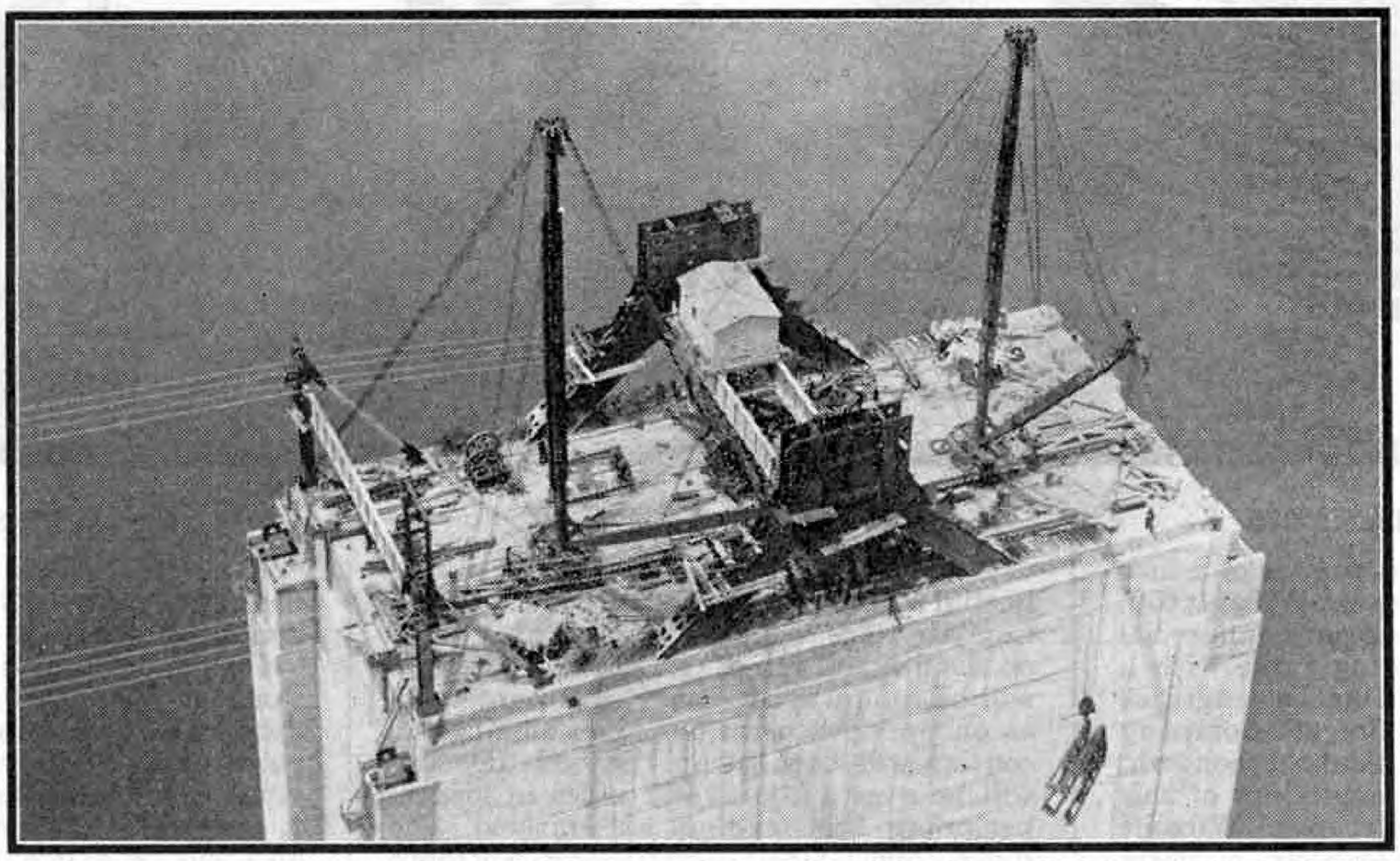
The first step was the construction of a great steel and timber caisson that measured 197 ft. by 92 ft., and was the largest ever built. Internally it resembled a gigantic egg crate, the compartments being 55 circular cylinders, or cells, each 15 ft. in diameter, built of steel piping. These cells were arranged in five rows. Their openings were covered with semi-circular steel caps, and compressed air was pumped into them in order to give buoyancy to the structure when it was afloat. The spaces around the cells and between the walls were filled with concrete, reinforced with a network of reinforcing rods; and to the bottom of the caisson was attached a steel cutting edge 17 ft. in depth.

When ready this unwieldy contrivance was towed out to the site, and elaborate arrangements were made for sinking it gradually. As it sank its timber walls were heightened, as were also the steel cells; and in the meantime more concrete was poured between the cells and the outer walls through large flexible pipes resembling elephants' trunks. Just before the cutting edge reached bottom the mass weighed no less than 80,000 tons, and was kept afloat by the terrific pressure of the compressed air in the cells.

Huge anchor chains held the great caisson in place until the time came for the most tricky and delicate part of the whole operation—that of bringing it to rest at the exact spot desired. Divers were

sent down to loosen the anchor chains, and the engineers took up their positions, anxiously sighting their instruments on distant points. The moment the caisson was in the right position the chief engineer gave a signal. Instantly the pressure of the air inside all the cells was reduced, and the cutting edge sank deeply into the mud, bringing the great caisson to rest. Dredging buckets were lowered into the cells and the mud was removed from them, this work being continued until the cutting edge had penetrated to bedrock.

When all the mud had been taken out, concrete was poured down through the cells until it formed a bed 10 ft. in depth on the rock on which the bottom of the caisson rests. The lower portions of the cells were then plugged with concrete to a depth of 34 ft. Above this height they contain water that has been allowed to flow in, except in the cases of three cells at each corner of the structure, or 12 cells in all, which are filled with concrete to a height of 25 ft. above the waterline. Thus the structure is solid to a height of 44 ft.



Work in progress on the central anchorage, 284 ft. above water level. The eight cables on the left are for the foot bridges, or "cat walks," above which the main supporting cables of the bridge will be spun.

The whole pier towers 504 ft. above bedrock, and 284 ft. of its height is above the waterline. The underwater portion is thus 220 ft. in depth, and constitutes the honeycombed portion with its 43 circular cells. Scientific tests have shown that piers designed with a honeycombed form of base are able to withstand earth tremors and the buffeting of currents and waves better than if they were built up entirely solid.

The walls of the pier above the water are more than 14 ft. thick, and into them are anchored great steel frames carrying the eye-bars to which the cables that support the roadway are attached. There are two cables, each 28¾ in. in diameter and containing 17,464 wires; and the anchorage will have to withstand a pull of 18,000 tons from each cable.

All told, about 18,500 tons of cable will be requisitioned in the erection of this single crossing. It will represent a length of 70,815 miles, or nearly three times the circumference of the Earth, and the total length of the 2¼ in. suspender ropes will be 43 miles. About 152,000 tons of structural steel will be used in the erection of the superstructure and more than 30,000,000 tons for reinforcing purposes. In the great bases of the piers alone there are more than 1,000,000 cu. yds. of concrete.

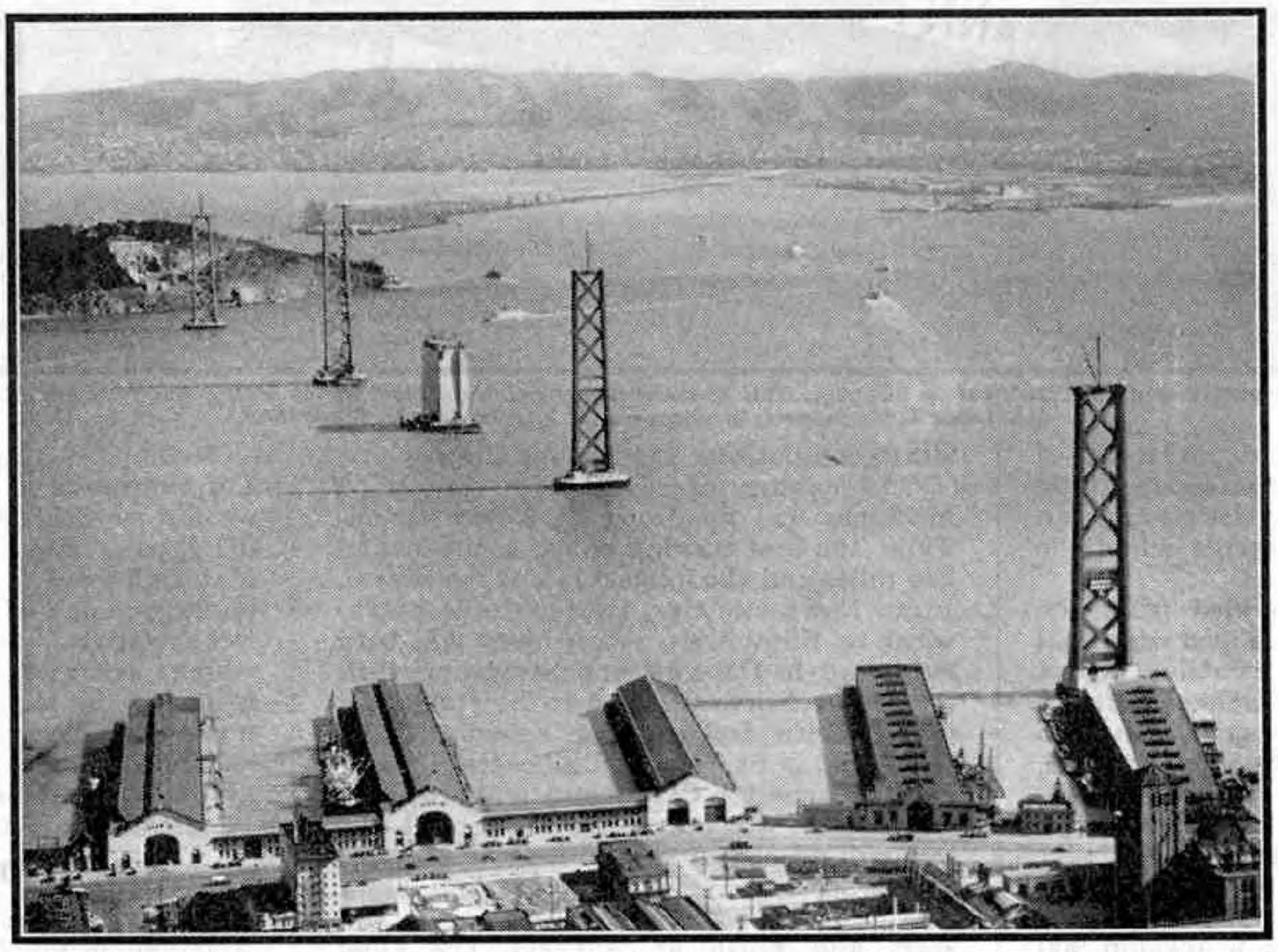
Everything in connection with the undertaking is on a colossal scale, and stresses and strains have been scientifically worked out to ensure perfect safety. Engineers have spent many days on top of the towers peering down on large ruled squares of paper that have enabled them to observe the movements due to wind and sun, and they declare that a tower may bend over as much as 3 ft. when fully loaded. The deck of the bridge is liable to sway several feet under the influence of wind pressure, and therefore will be attached to the piers by rocker arms in order to allow movement of this kind. As traffic rolls across the bridge the pull on the cables will cause a wave to roll forward, raising the deck ahead and depressing it underneath the vehicle to create a slight "S" formation; but the deck could be lowered as much as 8 ft. without danger to the structure and without being even noticed by passengers.

This colossus of bridges will carry two decks, the upper one, 58 ft. wide, providing six lanes for motor traffic, and the lower one being reserved for trains and tramcars. It is being built by the California Toll Bridge Authority, and the toll charges to begin with will be the same as those of the ferries, but will be reduced gradually over a period of 20 years, at the end of which no charge will be made for crossing.

A growing practice among bridge engineers is to construct scale models of the proposed type of bridge and use them in ascertaining what would be the effects of wind, change of temperature, load, etc., upon a full-size structure of the same design. In the case of the San Francisco—Oakland project, scale models were made of three of the designs of suspension bridge proposed for the Yerba Beuna Island—San Francisco section. Many tests were carried out with the models by Professor G. E. Beggs and others for the State of California Department of Public Works, and special measuring instruments were used in this work.

The towers of the model bridges were heavy steel tubes, and each was mounted on a roller-bearing trunnion placed in a position that corresponded to the top of a pier of the full size bridge. The towers and anchorages were erected on two horizontal 12 in. steel channel girders that rested on rollers on the top of concrete pedestals. The girders were fixed firmly to a centre pedestal, however, to prevent any stresses being imposed upon the model owing to changes of temperature.

It is very rarely that two great bridges are constructed simultaneously in the same part of the world. At San Francisco, in addition to the remarkable suspension bridge described in this article, structure of the same type but of different design is being erected across the Golden Gate, the waterway flowing past the tip of the pensinsula on which the city is situated. The bridge will be 6,450 ft. long, and will consist of a clear span of 4,200 ft. between the two main piers and two approach spans each of 1,125 ft. The deck will carry a 60 ft. roadway flanked by two sidewalks. A description of this fine structure will be given in an early issue of the *"M.M."*



Aerial view of the bridge across San Francisco Bay in course of construction, showing the concrete central anchorage and the tall steel towers erected between the city and Goats' Island, with Oakland in the distance.



The Breguet-Wibault 670

The illustration on this page is of a new French aeroplane, the Breguet-Wibault 670. It is an 18-seater passenger commercial monoplane of the low wing type, with a wing span of 80 ft. 9 in. and a length of 60 ft. 9 in. In 1934 the Breguet Company took over the Wibault-Penhoët concern, and the new machine is a product of this merger. The wings are of typical Wibault design, and are in three sections, a centre section of uniform thickness and two outer sections that taper toward their outer ends. They are constructed of duralumin, and have slotted ailerons for about two-thirds of the length of their trailing edge and slotted trailing-edge flaps for the remainder of the length.

The long fuselage, which is covered with duralumin, resembles that of the Breguet-Wibault triple-engined machines used on the European routes of Air France. It is built up of longerons and transverse frames and for most of its length it is of rectangular section. The undercarriage is of Breguet design and can be drawn up into the fuselage when the machine is in flight.

A good outlook is provided from the pilot's cockpit, which is equipped with dual control. Immediately aft of the cockpit is a compartment for the wireless operator, and behind this is a passenger cabin with 18 armchairs arranged in two rows of nine, each chair being alongside a large window. The cabin is entered at the rear end and behind the entrance vestibule are toilet and baggage compartments.

The two Gnöme-Rhöne "Mistral Major" engines of the machine each develop 900 h.p., and give the machine a top speed of 219 m.p.h. at 5,000 ft. They are of the air-cooled type, and the 14 cylinders of each engine are arranged radially in two rows.

* * * *

Regular air services are to be established between the capitals of Czechoslovakia and Russia as the result of an agreement signed in Moscow.



The Breguet-Wibault 670 described on this page. This 18-seater monoplane is produced by the Society Anonyme des Ateliers d'Aviation Louis Breguet, to whom we are indebted for this illustration.

King's Cup Air Race

One of the most popular annual events in civil aviation in this country is the King's Cup Air Race, which this year takes place on the 5th and 6th of this month. The race will be conducted by the Royal Aero Club, as on previous occasions. The eliminating contest will be held on the first day and will be over a course 947 miles in length, beginning and ending at Hatfield. The route covers Great Britain and Northern Ireland, and for the first time will necessitate competitors flying over the sea.

On leaving Hatfield the competing machines will fly direct to Newcastle-on-Tyne, the first turning point, a distance of 240 miles and the longest lap of the course. From Newcastle they will continue northward to Edinburgh, where they will turn westward to Glasgow and Stranraer; then across the North Channel to Newtownards in Northern Ireland. The return half of the flight is by way of Dalbeattie, Blackpool, Manchester, Cardiff and Southampton.

The final will be run on the second day and will consist of several laps of a circuit about 50 miles in length, giving a flight totalling about 350 miles. The course will start and finish at Hatfield. The chief award is the King's Cup, and another important prize is the Siddeley Trophy for the best performance by a Club machine. The £1,000 presented by Viscount Wakefield will be divided into three major awards of £500, £200 and £100 respectively, and subsidiary prizes will take up the remaining £200. The race is open to any type of all-British civil aircraft.

Soviet Six-Seater Aircraft

A new fast mail and passenger aeroplane has been built in Russia by the Kharkov Aviation Institute. It is named the "Kh.A.I.–1" and is of all-wood construction and equipped with a retractable undercarriage. There is accommodation for six passengers. The Soviet aero engine installed gives it a maximum speed of 205 m.p.h. A series of similar machines is to be built and will be added to the Civil Air Fleet.

Another six-seater machine recently produced in Russia is the "Stal 3," which is constructed entirely of stainless steel and cruises at 190 m.p.h. A new single-engined six-seater flying boat, the "MP–1", has been tested on the Black Sea. It has a cruising speed of 125 m.p.h., and ski runners can be fitted to the floats when necessary so that the machine can be used during the winter when the waterways are frozen.

Proposed Japan-Manchukuo Airship Service

A company known as the Pacific Airways Corporation is to be formed to operate an airship service between Tokio, the capital of Japan, and Hsinking, the capital of Manchukuo. A Zeppelin of the same type as the one now almost completed at Friedrichshafen will be ordered for the service which, according to *"The Aeroplane,"* it is hoped to inaugurate in the spring of next year. Eventually two more airships will be acquired, and the service extended first to Singapore and then across the Pacific Ocean to the United States.

Named R.A.S. Machines

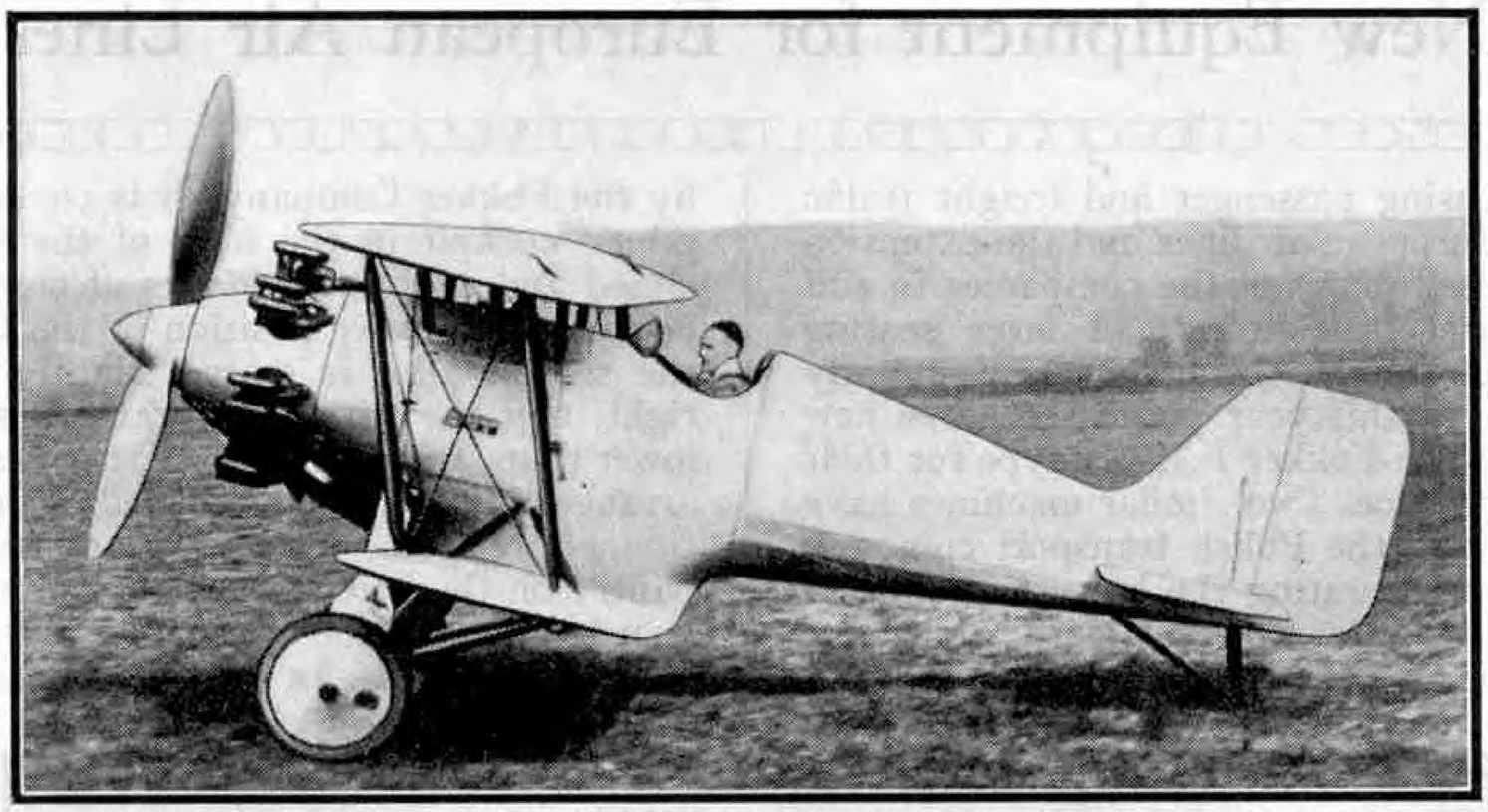
The aeroplanes used on the Plymouth-Nottingham and Liverpool-Brighton routes of Railway Air Services Ltd., have been named after important cities on their routes. The two machines flying on the Plymouth-Nottingham service are named *"The City of Plymouth"* and *"The City of Cardiff,"* and the two machines working the Liverpool-Brighton service are *"The City of Bristol"* and *"The City of Birmingham"*; these are D.H. "Dragon Rapides."

Great Research Station in Italy

Guidonia is the name of an elaborately equipped centre for aeronautical research that has been built near Rome. It is dedicated to the late General Alessandro Guidoni.

The research departments are housed in large buildings each devoted to certain branches of aeronautical investigation. They include a chemistry and physics building where the study of explosives and the testing of fuels, lubricants and doping materials is among the important work carried out; a wireless building devoted to the study of every aspect of wireless in relation to aircraft; and an aerodynamics building where the equipment includes a wind tunnel 9 ft. 9 in. in diameter and four smaller ones each 5 ft. 6 in. in diameter, centred round a lecture hall. There is a special sub-department in the chemistry and physics building in which a study is being made of luminous substances for use in connection with night flying. The aircraft construction building has all the necessary equipment for the construction of experimental machines, and in another building aero engines and airscrews are tested.

A miniature town has been built to accommodate and cater for the large staff employed at the research centre.



Blackburn "Lincock" single-seater fighter. Photograph by Real Photographs Company, Liverpool.

A New Record Non-stop Flight

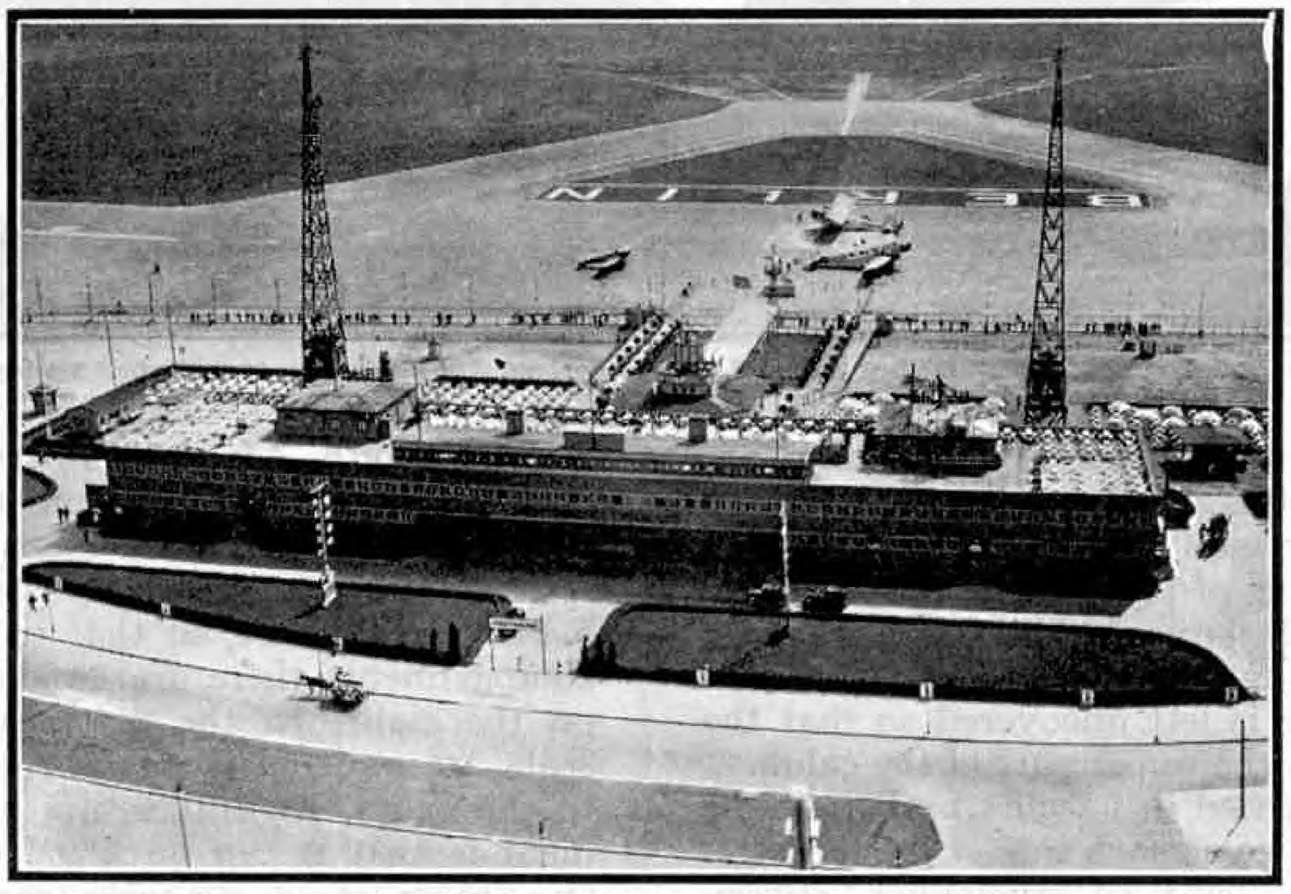
A new record for a long-distance non-stop flight has been set up by the *"Croix-du-Sud,"* a "Latecoere 300" flying boat that has flown from Cherbourg to Zinguichor, in Senegal, French West Africa, a distance of 2,685 miles. The machine is powered by four 650 h.p. Hispano-Suiza engines, and it is one of the big aircraft used on the French air mail line between France and Brazil and Argentina.

A notable flight on this line was made recently by the *"Centaure,"* a Farman 220 machine, which flew non-stop from Dakar, in French West Africa, to Natal, Brazil, a distance of 1,930 miles, in 14 hr. 52 min., which works out at an average speed of 129 m.p.h. The fastest time of the *"Croix du Sud"* on this run is 19 hr. 17 min.

More Zeppelins to be Built

An airship operating base is being constructed at Frankfort, and when finished it will replace Friedrichshafen as the base for the fortnightly airship service from Germany to South America. Friedrichshafen will then be concerned only with the construction of airships, and projects in view for which new vessels will be required indicate that it is likely to become very busy in the near future.

One Zeppelin is to be built for use on a proposed North Atlantic service under American auspices; another will be required in connection with an India-Batavia scheme in which the Dutch are interested; while a third will be built for the Japan-Manchukuo service mentioned in another column.



The Templehof aerodrome at Berlin, the headquarters of the Deutsche Luft Hansa organisation. Photograph by courtesy of Hansa Luftbild G.m.b.H., of Berlin.

Air Survey Developments

Last month we referred to the important aerial survey being carried out in Papua by H. Hemming and Partners Ltd., a London firm of air surveyors. The firm have now been retained in an advisory capacity by the Royal Netherlands Indian Airways, who are to survey from the air extensive oil concession areas in Dutch New Guinea for the Netherlands New Guinea Petroleum Company. The areas total about 40,000 sq. miles, and landing grounds are being laid out at four widely separated places in readiness for the aircraft that will be used for the work.

An important aerial survey is to be carried out also in England in connection with the revision of nearly 300 Ordnance Survey sheets. The contract has been obtained by Aerofilms Ltd., who are operating on behalf of H. Hemming and Partners Ltd. The area to be surveyed is in the Midlands and is about 260,000 acres in extent. A D.H. "Puss Moth" equipped with an automatic pilot to maintain it on an accurate and level course will be used. It will be specially adapted for the work, and will carry a Williamson "Eagle" camera with which photographs will be taken from a height of 8,000 ft. The photographs will be enlarged to a size that will enable them to be used as a basis for maps to a scale of 25 in. to the mile.

Airport at Weston-Super-Mare

A municipal airport is to be constructed at Weston-Super-Mare on a site 175 acres in extent that has been approved by the Air Ministry. When the aerodrome is available it will be used by Norman Edgar Western Airways Ltd. as the starting point for a ferry service to Cardiff. The service will be operated with three D.H. "Dragons," which will make the short trip in about 10 min. Next spring the company hope to run a daily service between the airport and Birmingham.

Piccard Stratosphere Flight Next Year

Professor Piccard, of Brussels University, is planning another ascent into the stratosphere, and is negotiating with a Polish firm for the construction of a special stratosphere balloon. It will be 328 ft. long and 197 ft. wide, and 21,528 sq. ft. of special silk will be used in making the envelope. The balloon will take almost a year to construct, and the ascent will take place next summer at Warsaw or at Zurich.

The Professor made his first flight into the stratosphere on 27th May, 1931. His balloon rose from Augsburg to a height of 51,458 ft., and descended on a glacier in the Oetz Valley in the Tyrol. He made a second flight on the 18th August, 1932, when his balloon started from Dubendorf Aerodrome, near Zurich, Switzerland, and attained a height of 54,450 ft., or nearly 10½ miles. The gondola of this balloon has been presented to the Science Museum, South Kensington. The professor hopes to reach a height of 98,425 ft. during his next flight.

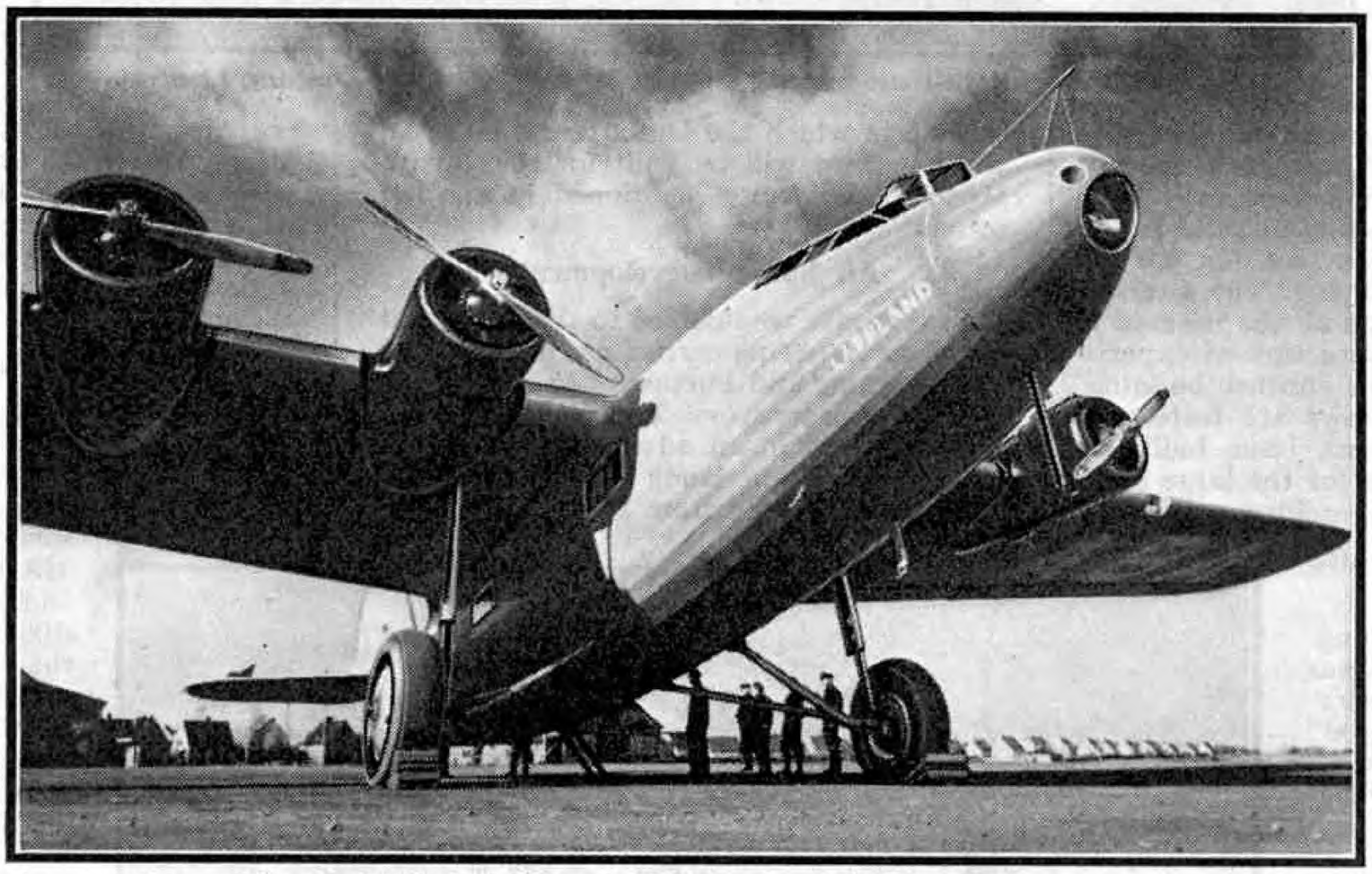
New Altitude Record

The altitude record for women flyers is gradually approaching that of the men, which is 47,340 ft. The women's record has been held since 1932 by Maryse Hilze, a French airwoman, who in that year flew to a height of 31,824 ft. She has now beaten her own record by attaining a height of 38,713 ft., her flight being made in a monoplane fitted with a 600 h.p. engine.

Fast Commercial Monoplanes

New Equipment for European Air Lines

THE rapidly increasing passenger and freight traffic of the principal European air lines and the extension of the routes has caused many of the companies to add to their fleets modern fast aircraft of large seating capacity. The Royal Dutch Airlines, more familiarly known as K.L.M., have this year purchased three new 22-seater machines of the Fokker F.XXII type for their Amsterdam-Batavia service. Two similar machines have been supplied to L.O.T., the Polish transport company with the distinction of operating the longest air line in Europe, from Revel, in Esthonia, to Salonica, a distance of 1,800 miles. The first Fokker F.XXII to be produced was delivered in February last to the Swedish Aerotransport company. It has been named the "*Lappland*," and is illustrated on this page. Swissair, the largest air transport company in Switzerland, have augmented their fleet with four 14-passenger Douglas D.C.2s. In this article we describe these two types of commercial aircraft.



An unusual view of "Lappland," the first Fokker F.XXII monoplane. The illustrations to this article are reproduced by courtesy of the N.V. Nederlandsche Vliegtuigenfabriek.

The Fokker F.XXII is a high wing monoplane and is produced by the well-known Fokker Company, of Amsterdam. The massive cantilever wing is built in the usual Fokker manner, and consists of two wooden spars with ribs and covering of plywood. It is 98 ft. 4 in. in span, and is fitted with flaps along the trailing edge to reduce speed on landing. The under surface of the centre section of the wing is left uncovered so that the space in this section forms the upper part of the cabin.

The four engines are carried in nacelles built into the leading edge of the wing, two on each side of the fuselage. They may be of any air-cooled type developing between 500 and 600 h.p., but the machine usually employs four Pratt and Whitney "Wasp" engines each of 525 h.p., which give a maximum speed at 5,000 ft. of 177 m.p.h., and a cruising speed of 157 m.p.h. The engines drive variable-pitch airscrews and are fed by motor pumps from four petrol tanks with a total capacity of 594 galls., installed in the wing between the spars, as is customary with Fokker aircraft.

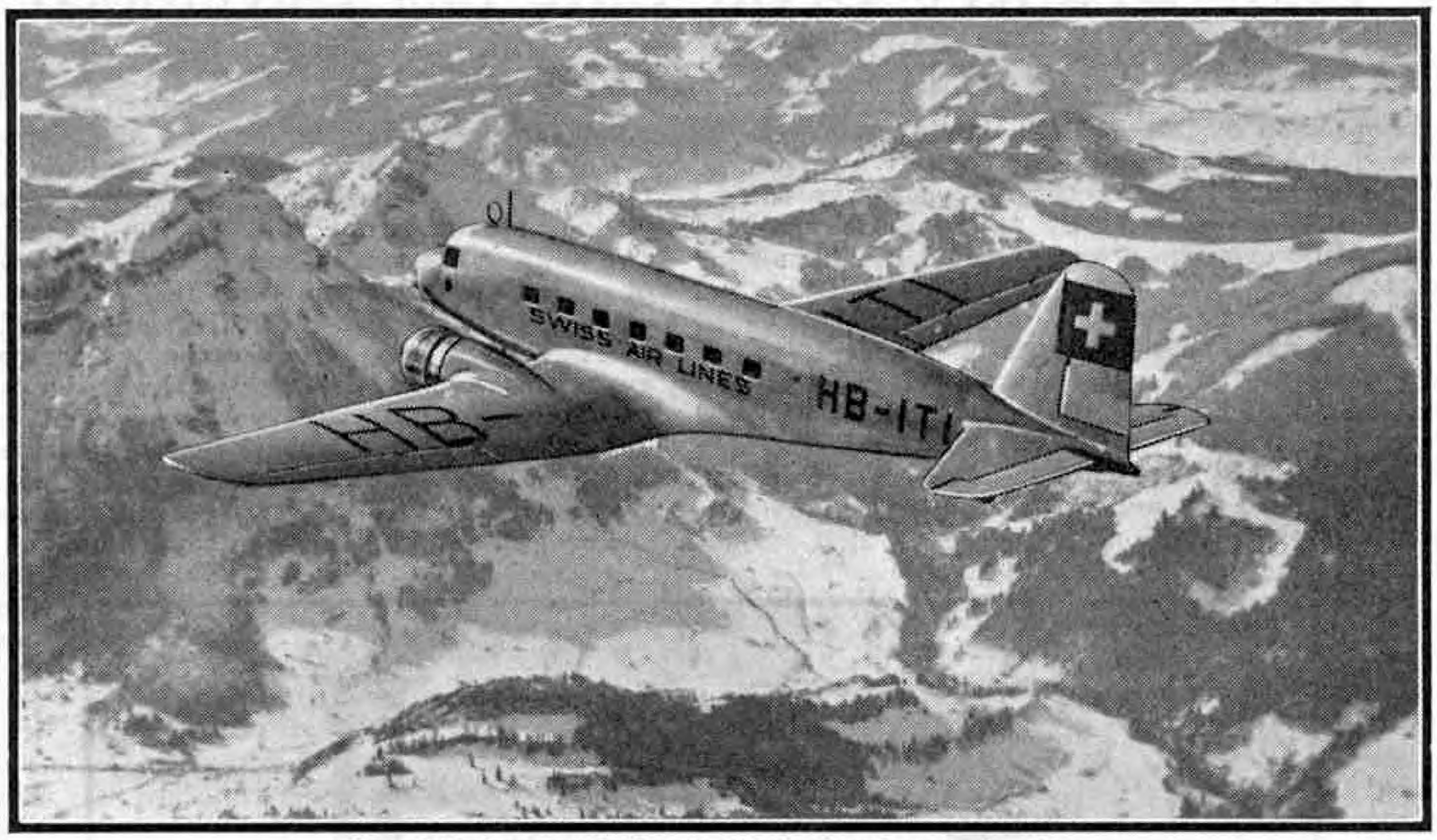
The fuselage is elliptical in cross section and is built of seamless cold-drawn steel tubes welded together under a special system of construction that has been patented by the Fokker Company. It is covered with fabric. The pilots' cockpit in the nose of the fuselage is fully enclosed and contains two sets of controls. The first pilot occupies a midway position in the front of the cockpit; the second pilot is seated slightly behind and to the right, and the wireless operator sits facing aft, a little lower than, and to the left of, the first pilot. This seating arrangement has been designed to facilitate communication between the crew. Behind the cockpit there is a pantry on the port side and a compartment on the starboard side for the mechanic and the steward. This compartment has an electric kitchenette and a buffet from which the steward serves meals to the passengers while the machine is in flight. There is a separate entrance to the crews' quarters, on the port side of the fuselage, so that there is no need for them to pass through the passengers' cabin when entering or leaving their positions.

A sliding door separates the cockpit from the spacious cabin provided for the passengers. This cabin is 26 ft. 3 in. in length, 7 ft. 3 in. in width and in height, and is divided into four compartments in three of which seating is provided for six persons and in the rearmost one for four persons. The aisle is not down the centre but a little to the left, so that in each of the three larger compartments there are two seats on the left and four on the right. In the rearmost one the two left-hand seats are omitted to make room for the entrance door to the cabin. An interesting point about this compartment is that it can be fitted out as an ambulance for the transport of stretcher cases, a purpose for which commercial aircraft are being used increasingly. The luggage, mail and freight are accommodated in a compartment behind the cabin and also in the wing.

The undercarriage is of the divided type. In each half a vertical shock-absorbing strut extends from the front wing spar to the wheel axle, which is attached to the fuselage by a "V" strut. The tail unit is of the normal monoplane type, with a tail-plane constructed of wooden spars and ribs covered with plywood. The fin, rudder and elevator are made up of steel tubes with a covering of fabric, and the fin is welded to the fuselage. Trimming

flaps are fitted to the rudder and the elevator. The tail-wheel is equipped with a balloon tyre.

The Douglas D.C.2 is an American type of monoplane introduced by the Douglas Aircraft Company, Inc., of Santa Monica, California. Last year the Fokker Company secured the sole right to manufacture and sell this type in European countries, excluding Russia, and the four D.C.2s recently supplied to Swissair were produced at the Fokker works. It differs in many respects from the Fokker F.XXII, chiefly in being a low wing machine and in having two engines instead of four. The wing is of 85 ft. span and tapers in width and thickness towards the outer ends. It is constructed entirely of duralumin, and the centre section extends underneath the fuselage. The trailing edge is equipped with ailerons near the wing tips, and the remainder of the edge incorporates an adjustable flap for reducing landing speed.



One of the four Douglas D.C.2s of Swissair flying over the Alps.

The fuselage is of monocoque construction and is built entirely of duralumin. The tail unit also is of this alloy, and the fin and tail-plane are in one piece with the fuselage. The rudder and elevators are covered with fabric and have trimming flaps that can be adjusted while the machine is in the air. The undercarriage is in two parts, and the wheel of each part is carried in a fork formed by two shock-absorbing struts and is fitted with a hydraulic brake. The undercarriage can be drawn up when the machine is in flight, and the wheels then retract about 60 per cent. into nacelles provided for them in the underside of the wing. The protruding portion of the wheels is sufficient to enable the machine to make an emergency landing with the undercarriage retracted.



The "Lappland" in the air. This machine is owned by the Swedish Aerotransport company.

The pilots' cockpit in the forward part of the fuselage has a good outlook. Behind it is the main cargo and mail compartment, and aft of this is the passengers' cabin, which is connected with the cockpit by a corridor. Between the cargo compartment and the passengers' cabin is a bulkhead $2\frac{1}{2}$ in. thick to deaden the noise when loading and unloading operations are in progress.

The 14 seats in the main cabin are arranged in two rows, and are placed sufficiently high above the wing for the passengers to have an excellent outlook through large windows alongside them. Each seat is mounted in rubber to reduce vibration to a minimum, and can be adjusted to enable the passenger to recline at ease or to face rearward. The heating and ventilation of the cabin can be regulated. A buffet containing a refrigerator and equipment for the serving of meals while the machine is in flight is situated behind the cabin, and in the rear part of the fuselage there is another baggage compartment.

The two engines employed in the Douglas D.C.2 may be of any air-cooled type developing between 700 and 1,000 h.p. Many of the machines are fitted with Wright "Cyclone" engines of about 710 h.p., which give a maximum speed of 210 m.p.h. The engines are enclosed in nacelles situated on each side of the fuselage and faired into the wing. The four fuel tanks have a total capacity of 425 galls. and are carried in the centre section of the wing.

The Douglas D.C.2 is 12,114 lb. in weight when empty and is capable of carrying a useful load of 5,886 lb., making a total weight of 18,000 lb. The machine normally has a ceiling of about 23,620 ft., and with one engine out of action it can maintain an altitude of about 9,500 ft. when carrying a full load.

As far as Europe is concerned the Douglas D.C.2. may be said to have come into prominence as the result of its success in the MacRobertson Air Races last year which demonstrated clearly its qualities for long-distance flights. The machine is used on many important long services in America, including the New York—Los Angeles line of T.W.A., which provides the fastest coast-to-coast flight by covering the 2,613 miles in 18 hrs.

The Centenary of the G.W.R.

How Brunel's Great Line has Developed

THE date of the publication of this issue of the "*M.M.*," 31st August, coincides with the centenary of an important event in British railway history. On this day exactly 100 years ago the "*Great Western Railway*" was incorporated by Act of Parliament. It has retained the same title ever since, and it would be difficult to find a more suitable name.

The line originated in the desire to provide railway communication between London and Bristol. Although as early as 1824 it was proposed to lay down a railway, it was not until 1832, after the success of the Liverpool and Manchester Railway had been assured, that any definite steps were taken. Four Bristol merchants then revived the interest in a railway to London, and eventually a survey of the route was arranged for, and the Engineer appointed was Isambard Kingdom Brunel, then only 26 years of age.

Before the construction of the line was commenced, Brunel, with characteristic originality, proposed that it should be laid to a larger gauge than previously employed to make the utmost use of the well-graded route he had secured, for high-speed travelling in safety. It was his intention to use large wheels for the coaches with the bodies slung between them for steadiness, hence the necessity for the wider gauge. Consent being obtained, he laid the line to a gauge of 7 ft. 0¼ in., as opposed to what was then called the narrow gauge of 4 ft. 8½ in., adopted by Stephenson. This had the effect of isolating the Great Western system and the broad gauge lines connected to it from other railways in the country, so that through traffic between them was impossible. Thus trouble arose where the broad gauge G.W.R. met the "narrow" gauge lines of other companies. Especially was this so at Gloucester, where the transhipment of through goods from either system to the other had to be carried out. The resulting confusion was such that "Gloucester" became the standing excuse for everything that went wrong. When the G.W.R. were authorised to lay a broad gauge line from Oxford through Worcester to Wolverhampton, the complaints were so serious that a Parliamentary enquiry was held into the whole gauge question, and this led to the standardisation of the narrow or 4 ft. 8½ in. gauge. On the other hand the G.W.R. were allowed to proceed with a broad gauge line from Oxford to Birmingham, provided that they laid in a narrow gauge rail as well. This really was the thin end of the wedge that led finally to the abolition of the broad gauge. In 1868 came the first conversion to the narrow gauge, and in 1892 the final stage of the process took place.

Brunel's broad gauge track has long since passed away, but some of his remarkable bridge and tunnel constructions still survive on the G.W.R. of to-day. To get his original line to Bristol he had some difficult engineering to carry out. Wharncliffe Viaduct, Maidenhead Bridge—incorporating remarkably flat arches in brickwork—and Box Tunnel are all well known. The tunnel was the cause of a great deal of controversy in the Parliamentary proceedings before the G.W.R. Act was passed. The opponents of the scheme called it "most dangerous and impracticable." One witness stated that the noise of two trains would be excessive, "I do not know such a noise," he said; and added emphatically: "No passenger would be induced to go twice."

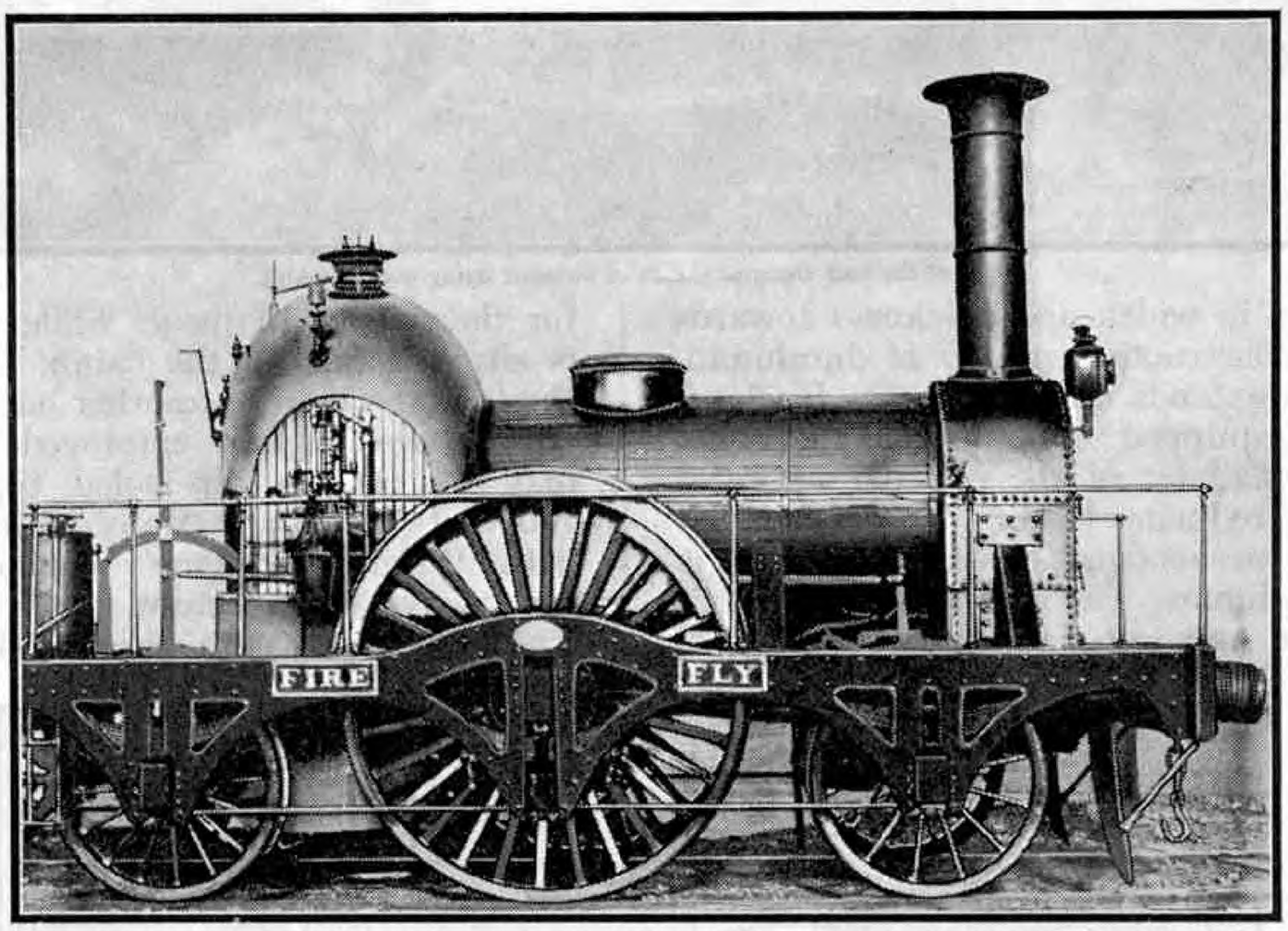
Crossing from Devon into Cornwall over the River Tamar the G.W. line runs over the remarkable Saltash Viaduct—the last bridge built by Brunel and the last indeed of all his works. The two main spans consist each of a single arched tube, with the ends of each tube resting on piers rising from the water. Suspension chains join the ends of each tube and are braced to them along their length. Each span therefore forms virtually a bowed trussed girder, from which the deck of the bridge is suspended. In Cornwall the numerous valleys were crossed by a notable series of wooden viaducts. The soundness of their design and construction is shown by the fact that only recently has the last of them—the Collegewood Viaduct—been replaced by a more modern structure.

The greatest engineering feature on the G.W.R., the Severn Tunnel, came after the time of Brunel. Its purpose was to provide a more direct gateway to South Wales than the old route via Gloucester. The construction of the Severn Tunnel was an epic struggle against the difficulties occasioned by the water breaking into the workings. Even now many thousand gallons are pumped out daily by the powerful pumps installed, and 34,061,578 gallons have been raised in a single day. Construction was in progress for 13 years, and 76,000,000 bricks were used. With a length of 4 miles, 624 yards, it is the longest tunnel in the Kingdom, and the longest underwater tunnel in the world.

By means of the Severn Tunnel the G.W.R. connection with Ireland also was facilitated. In order to provide suitable accommodation the present port of Fishguard was literally created and built on a ledge blasted out of the rock on the water's edge. Fishguard is suitable for both cross-channel and ocean traffic, and is a fine example of an efficient railway port. It has enabled the G.W.R. to build up their now extensive Irish traffic, to Rosslare, Waterford and Cork.

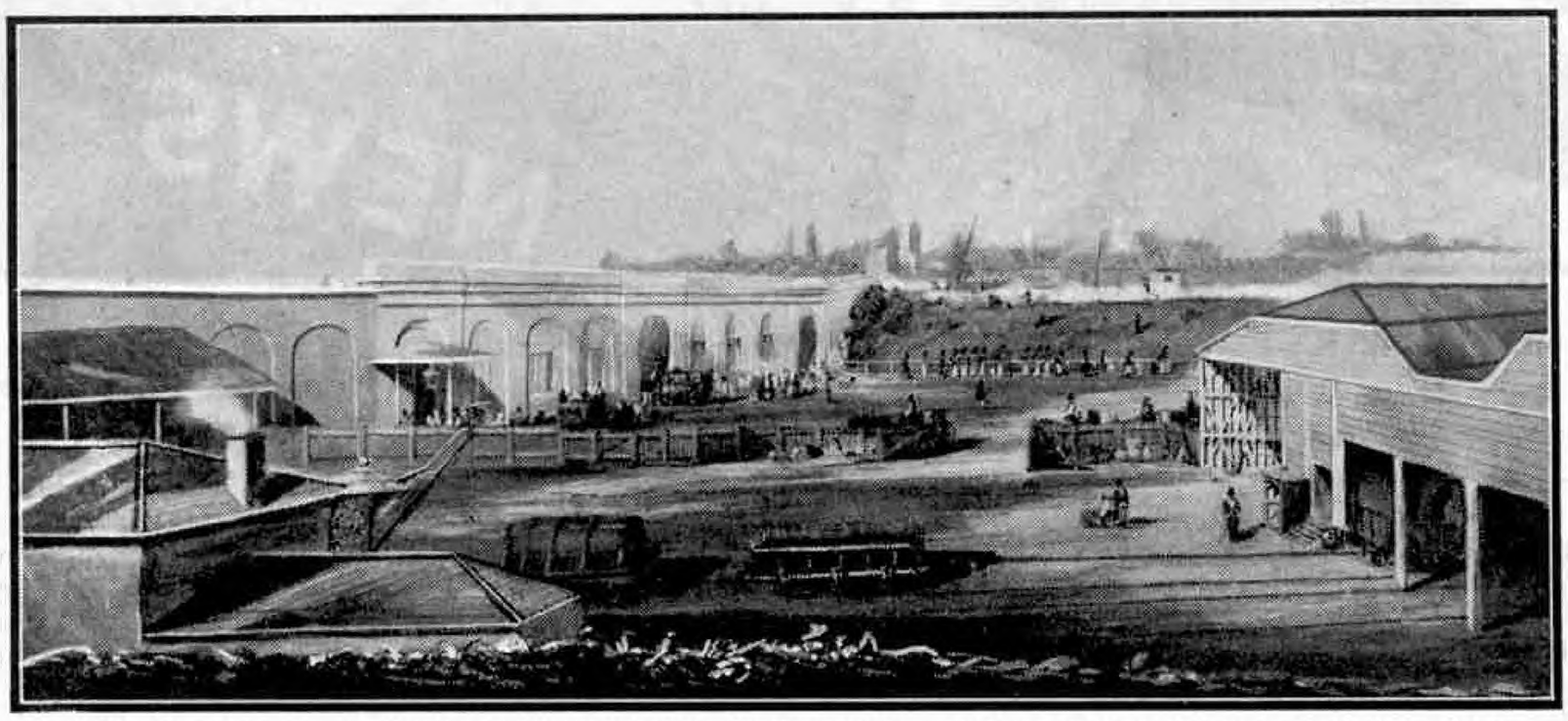
If the engineering developments of the G.W.R. of the past 25 years have been somewhat less spectacular than those we have been describing, they have been none the less important. By providing cut-off lines or, to use a now familiar term, by-pass routes, on Brunel's "Great Way Round," as the G.W.R. was once known, the route to the West of England has been shortened. More recently important facilities have been provided for through traffic at important junctions such as Westbury and Taunton. The old route to Birmingham and the North is shortened. Another development has been the new "West to North" main line, so that there has been a gradual straightening process applied to practically all the G.W.R. main lines, enabling accelerated and constantly improved services to be afforded.

The speed of the G.W.R. express trains is well known, and the services to-day are worthy successors of the old broad gauge trains. As early as 1845 the 9.45 a.m. from Paddington had to run to Didcot in 67 min. for the 54 miles. Later came such trains as the "*Flying Dutchman*," the first "*Cornishman*," and then the first "*Cornish Riviera Limited*" of 1905. From these the "*Cornish Riviera Express*" of modern times developed, and for 20 years this made the longest non-stop run in the world, over the 225¾ miles



"Firefly," the first locomotive delivered to the designs of Daniel Gooch, the first G.W.R. Locomotive Superintendent. It incorporates features that were characteristic of broad gauge engines for many years. This and the other illustrations to this article are reproduced by courtesy of the G.W.R.

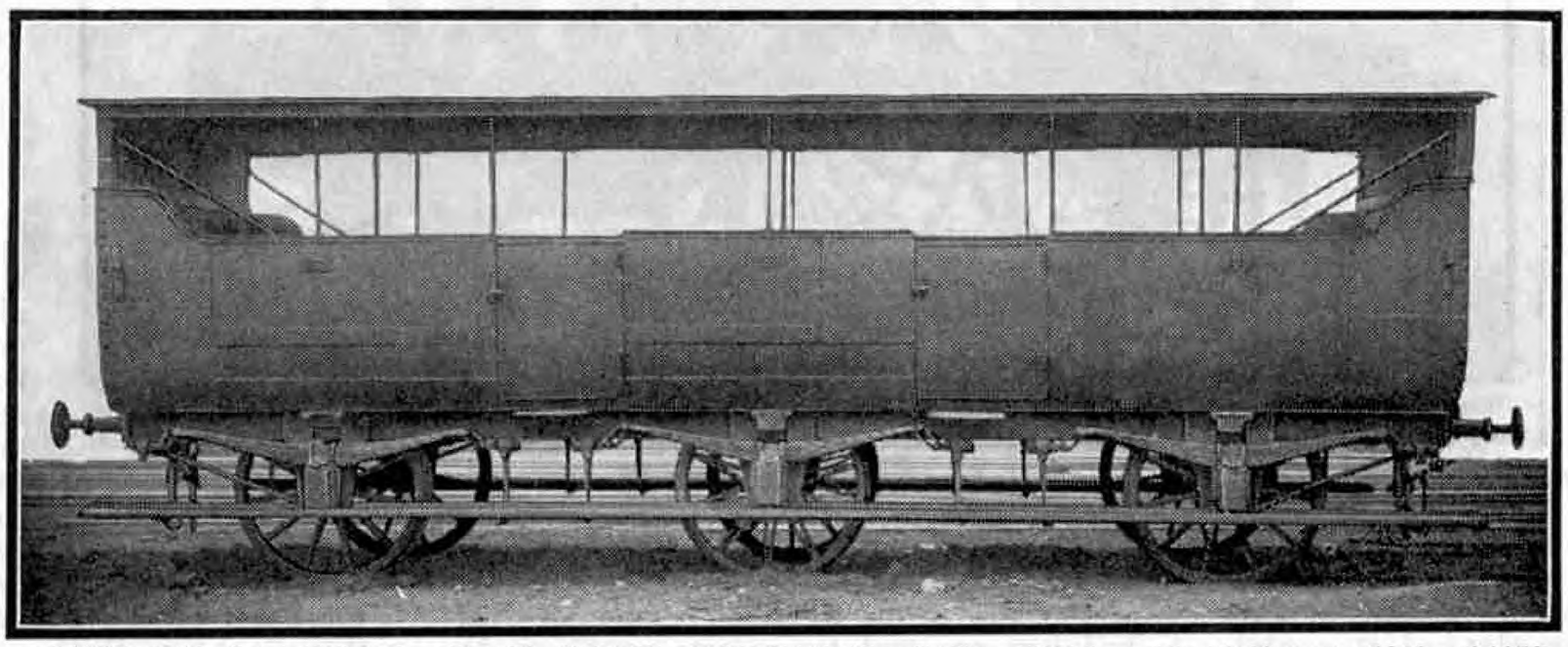
from Paddington to Plymouth. This year traffic development has made necessary the division of the train and has led to a revival of the exclusive character and name of the *"Cornish Riviera Limited"* for the main portion. The second portion of the train is known as *"The Cornishman."* The *"Cheltenham Flyer"* held for years the proud position of the world's fastest train, and is still the fastest in this country. Although its average speed is 71.3 m.p.h. over the 77¼ miles from Swindon to London, it is a remarkably good time-keeper, and is operated with standard equipment.



An interesting view showing the front of the original Paddington Station. The open nature of the country in the neighbourhood makes a striking contrast with the Paddington of the present day.

From the earliest times G.W.R. locomotives have always been distinctive. The fact that the early engines were required to run on rails 7 ft. apart, instead of 4 ft. 8½ in., naturally involved some difference from the usual standards of locomotive construction. Of the earliest locomotives the best was undoubtedly *"North Star,"* which hauled the first train from Paddington to Maidenhead on 31st May, 1838. Of this engine Daniel Gooch, the first G.W.R. Locomotive Superintendent, wrote: *"North Star,"* being the most powerful one, and in other respects the best, was my chief reliance." It was withdrawn from service in 1870, but was actually in existence until 1906. After being dismantled in that year it was again reconstructed in 1925, with some of the original parts, in order to enable it to appear at the Stockton and Darlington Railway Centenary celebrations at Darlington. It subsequently visited America in 1927, and appeared at the "Fair of the Iron Horse," held by the Baltimore and Ohio Railroad. This year it took part in the film that was specially made by the G.W.R. to commemorate the centenary of the company.

The sister engines of *"North Star"* were all named after "Stars," so that the practice of naming engines of the same class in a similar fashion, that is so characteristic of G.W.R. practice to-day, is almost as old as the company itself. Gooch's first engines of 1840 to 1842, based on the same design, were so successful that no further locomotives were required for some years. During the gauge controversy a great deal of attention was paid to locomotive efficiency, and comparative trials between broad and narrow gauge engines were decided upon. After some preliminary running, a much enlarged engine, appropriately named *"Great Western,"* was constructed in order to show what the broad gauge could do. This was the first locomotive completely constructed at Swindon Works, and was the prototype of the famous 4–2–2 engines such as *"Lord of the Isles."* That the design was a good one may be gathered from the fact that, with suitable modifications, it remained the standard broad gauge type of express locomotive for more than 40 years.



A G.W.R. third-class coach with open sides. Vehicles of this type had iron bodies and were constructed between 1840 and 1850.

The adoption of the mixed gauge led to the building of narrow or standard gauge locomotives, in addition to those of the broad gauge. The first standard gauge locomotives for the G.W.R. were constructed in 1855 to Gooch's designs, by Beyer, Peacock and Co., of Manchester.

The "single-wheeler" type of locomotive had a long reign on G.W.R. express work, the last of the type being built in 1899. Coupled engines were of course in use long before that, but the coupled type for passenger work was never prominent until increasing loads and higher speeds demanded greater steaming power and greater adhesion. Even then the 4-coupled type was quickly superseded by the 4–6–0 for the fast and heaviest trains, and the 4–4–0 express locomotive is now obsolete on the G.W.R. The first design of 4–6–0 for passenger work appeared in 1902 with two cylinders, and a few years later came the introduction of the four-cylinder type. Both types incorporated the principle of using a high steam pressure with long-travel valves, enabling the engines to be driven economically on short cut-offs, which has since been adopted on other railways. Both two-cylinder and four-cylinder types were developed, but the latter has been preferred for the heaviest work and is exemplified in the splendid "Castles" and magnificent "Kings" to-day. The two-cylinder 4–6–0 type is widely used, however, and finds expression in the useful "Hall" class.

Similar constructional principles, including the characteristic domeless tapered boiler and Belpaire fire-box, have been applied to all G.W.R. locomotives, both tender and tank, with the exception of the smaller tank classes built to replace similar older engines on particular duties. The G.W.R. thus possess a range of standard locomotives for different duties that are perhaps more characteristic than those of any other line.

In addition to affecting locomotive practice in this country, it is interesting that G.W.R. design has had its influence also in the United States, as a result of the appearance of *"King George V"* that took part in the "Fair of the Iron Horse" held at Baltimore in 1927. This has resulted in the appearance of several locomotives on U.S. railroads of far neater outline and finish than has usually been the practice there. Such details as the characteristic copper cap of the chimney of *"King George V"* also have been copied.

On the whole, G.W.R. rolling stock is as individual in style as the locomotives. The distinctive colours of the passenger coaches enable them to be identified anywhere, apart from the features of design. The use of steel body panels and roofs is as characteristic now as were the elegant bodywork and clerestory roofs on the old stock. The standard of comfort is very high, especially in the new *"Cornish Riviera Limited"* stock and the special "Super-Saloons." The G.W.R. indeed appear to prefer to provide their own luxury vehicles; and Pullman cars, the special purpose of which is to provide the utmost travel comfort, were used only for a short time in 1929-30. Restaurant and buffet services are fully provided, and perhaps the most interesting application of the latter is found in the streamlined heavy oil-engined railcars that operate between Birmingham and Cardiff.

As in their provision for speed and comfort, so do the G.W.R. take special measures to ensure safety. All the main line routes are fitted up with the G.W.R. system of automatic cab signalling and train control apparatus. This gives a definite indication to the engine driver of the state of the road ahead, and makes it impossible for a train to pass a home signal at danger.

From Brunel's original main line the Great Western system has developed to serve roughly the area enclosed by the triangle formed by London, Birkenhead, and Penzance; and it includes 255 separate undertakings. The company also own the world's largest dock system.



Fine Running on the L.M.S.R.

We have received from Mr. O. S. Nock the following details of a journey from Euston to Heysham.

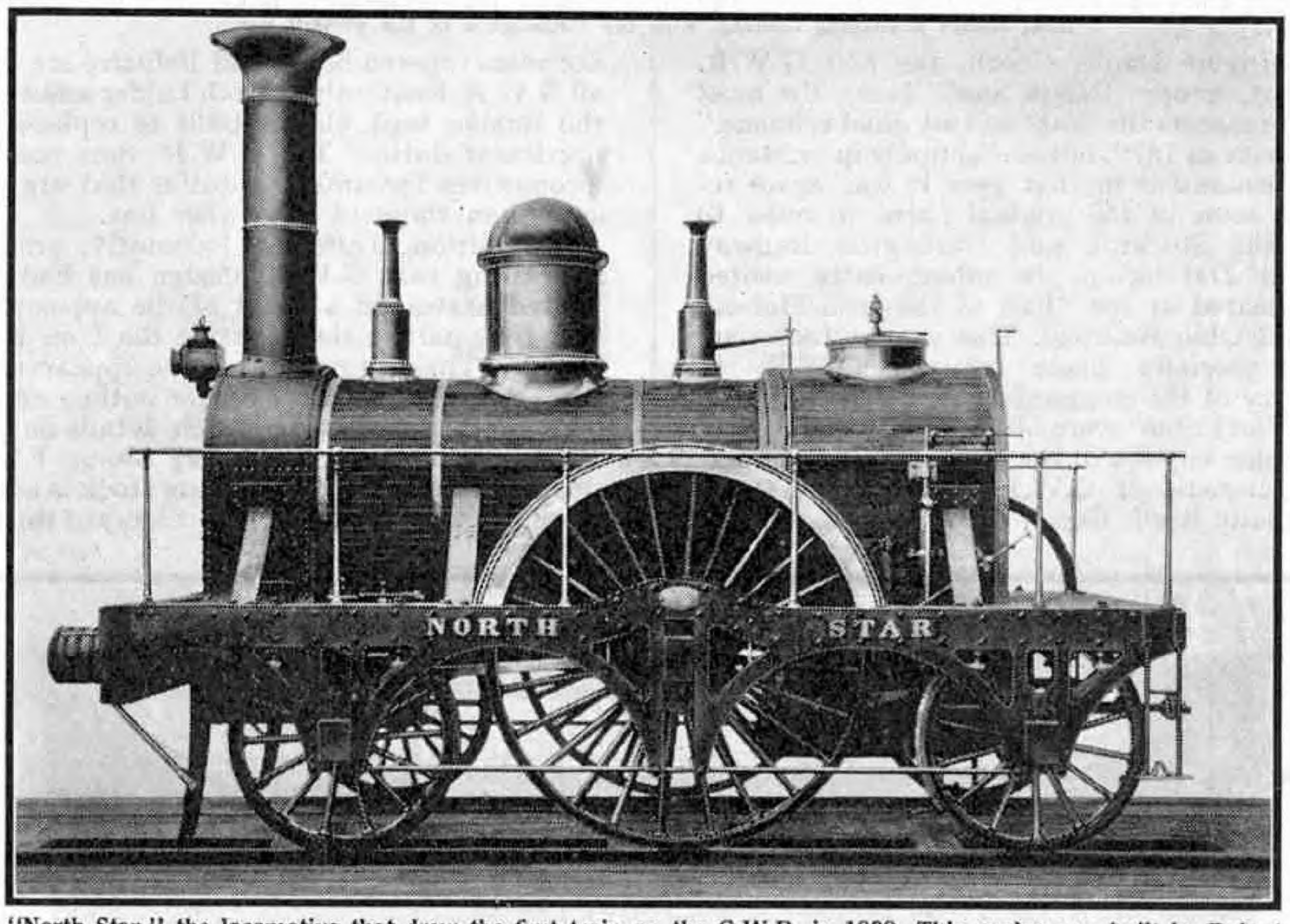
With a load of 481 tons tare, and 520 tons full, behind "Royal Scot" No. 6134, *"Atlas,"* the running was sound without at any time arising to any great distinction. After easy early stages to avoid overtaking the 6.5 p.m., Rugby was passed in 88 min. 38 secs. Then despite a very severe slowing at Polesworth pitfall, the remaining 75.5 miles to Crewe took 78 min. 12 secs.

At Crewe, No. 5970, *"Patience,"* a rebuilt "Claughton" with Walschaerts valve gear, came on to the reduced load of 439 tons tare, 475 tons full, and the work onwards to Preston was really magnificent. After passing Minshull Vernon, 4.9 miles, in 6 min. 57 secs. at 60 m.p.h., Winsford Junction, 8.8 miles, in 10 min. 31 secs. at 75 m.p.h., speed lay entirely between 71½ and 75 until a heavy slack to 51 over Weaver Junction. With speeds of 69 m.p.h. at Moore troughs, and 61 m.p.h when crossing the Ship Canal, Warrington, 24.1 miles was passed in the remarkable time of 24 min. 37 secs. Then came a delay that cost nearly 5 minutes, the train being almost stopped by signal at Winwick Junction. Recovering splendidly to 62 m.p.h. before Wigan, Boar's Head bank was climbed at a minimum of 41 m.p.h., and then came a p.w.r. check to 35. Speeds were 73 m.p.h. at Balshaw Lane and 74 m.p.h. at Farington, and time would practically have been kept to Preston but for a dead stop on the Ribble Viaduct, in 58 min. 32 secs. from Crewe; the schedule time is 58 min. The actual arrival at Preston was in 61 min. 53 secs. but the net time was only 54½ min.

Beyond Preston, speed was maintained at 63 m.p.h. to 65 m.p.h. along the level towards Lancaster, but a succession of severe checks spoiled the end of the run from Lancaster to Morecambe Promenade. Driver G. Farrer, and Fireman F. Cooke of Carnforth shed were in charge.

Britain's Longest Through Engine Working

The L.M.S.R. have recently established a new record for the longest through engine working in this country. This involves the return trip from London to Aberdeen and back, covering a total mileage of 1,079½. The locomotive concerned is of the "Royal Scot" class, and leaves Euston at 7.30 p.m. with *"The Royal Highlander"* express. It reaches Carlisle at 1.38 a.m. and is refuelled before proceeding at 5.16 a.m. with another express to Aberdeen, where it waits for 2½ hours before returning with an express fish train at 1.55 p.m. When Carlisle is reached again a fresh supply of fuel is taken on, and the engine continues to London with the 1.7 a.m. sleeping car express, arriving at Euston at 7.25 a.m., almost exactly 36 hours after leaving the Metropolis. This new schedule forms part of a scheme instituted by the L.M.S.R. for the purpose of obtaining more economic use of its locomotives.



"North Star," the locomotive that drew the first train on the G.W.R. in 1838. This engine was built by Robert Stephenson & Co., and after being rebuilt in 1854 continued in service until 1870. Photograph by courtesy of the G.W.R.

The L.M.S.R. "Princesses"

It is anticipated that the L.M.S.R. will put into traffic this year 10 locomotives of the 4–6–2 "Princess Royal" class. These will be numbered 6203 to 6212, and at the time of writing Nos. 6203-07 are in traffic. They are named respectively *"Princess Margaret Rose," "Princess Louise," "Princess Victoria," "Princess Marie Louise"* and *"Princess Arthur of Connaught."*

Although generally of the same design as Nos. 6200 and 6201, they incorporate certain minor modifications that have been made as a result of the experience gained with the first two of the class. The dimensions of the cylinders, driving wheels and the boiler pressure are the same, however, so that the tractive effort remains unchanged. As in the case of the "Turbomotive" No. 6202, described on page 466 of last month's *"M.M.,"* the inner fire-box projects into the boiler barrel to form a combustion chamber. Needle roller bearings are applied to the motion pins of the valve gear, with the exception of the joints of the return cranks and the outside eccentric rods, which are fitted with self-aligning radial ball bearings. Steam operated sanding gear has been incorporated, whereas on the original engines hand operation was employed.

Southern Railway Developments

The Eastbourne electrification of the Southern Railway, which has been in operation since July last, has been partly responsible for a speeding up of the Portsmouth services. The accelerated trains on the "direct" line from Waterloo are worked by "Schools" class engines displaced from the Eastbourne route, and Nos. 924-933 of this class are stationed at Fratton shed. For the first time on record Portsmouth is brought within 90 min. of Waterloo.

The *"Bournemouth Limited"* is accelerated slightly to a schedule of 1 hr. 58 min. and the sectional time between Waterloo and Salisbury of the first portion of the *"Atlantic Coast Express"* is now 87 min. This corresponds to that of the 3 p.m. West of England express, hitherto the fastest train in the S.R., and requires the maintenance of an average speed of 57.8 m.p.h.

The S.R. announce that their narrow gauge line between Lynton and Barnstaple is to be closed when the summer service terminates. This interesting system was formerly an independent line opened in 1898.

The "*Cornish Riviera Limited*"

Since the commencement of the summer service on 8th July last, the "*Cornish Riviera Express*" has been regularly divided into two trains. The first, leaving at 10.30 a.m., has reverted to the original character and title of the train in that it conveys only passengers who have booked their seats, and is known as the "*Cornish Riviera Limited.*" The second portion, leaving at 10.35 a.m., revives an old title as "*The Cornishman.*"

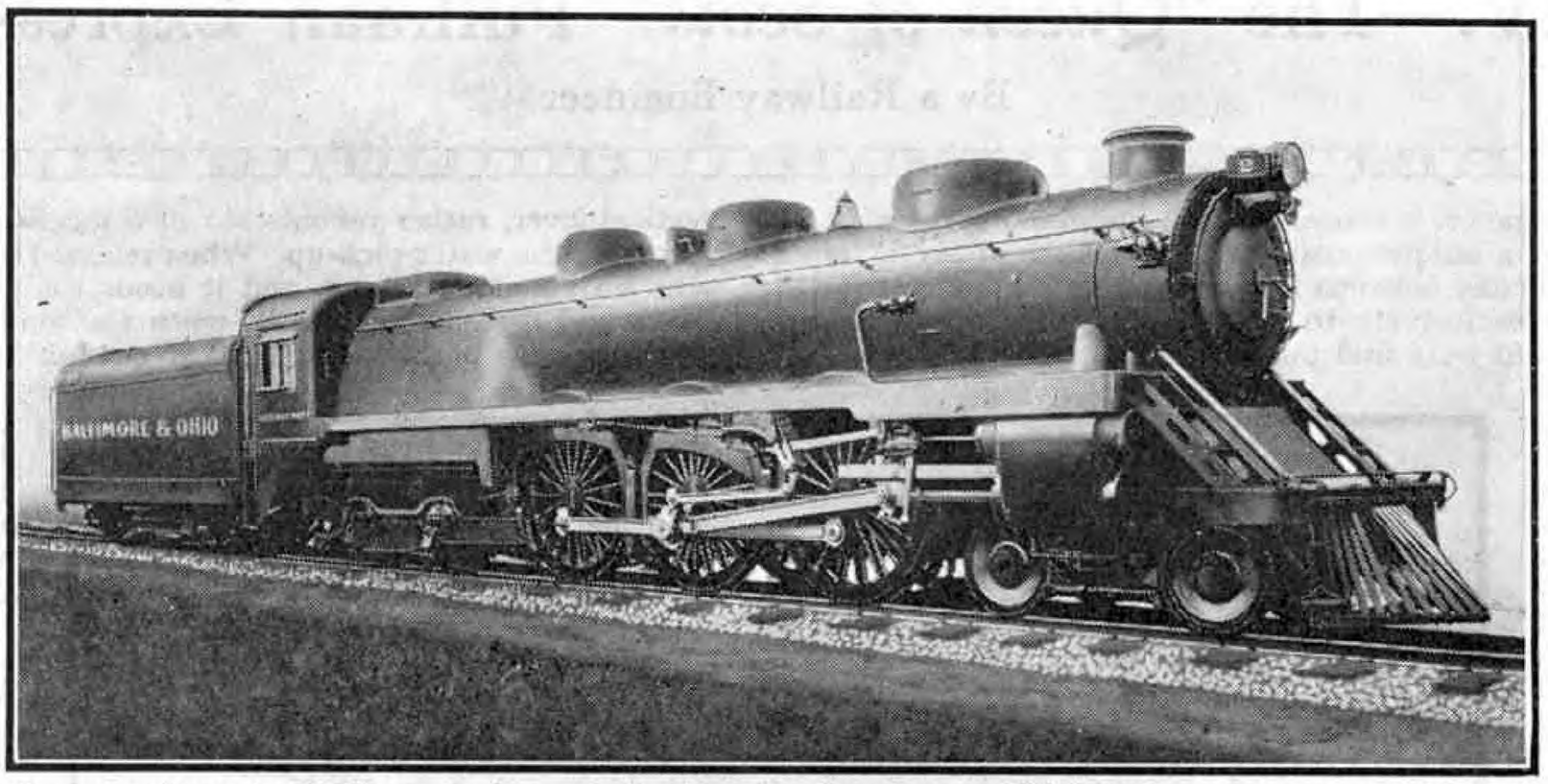
For the "*Limited*" two completely new trains of the most luxurious character have been provided. Each vehicle is 60 ft. long and has an extreme width of 9 ft. 7 in. The cars are of vestibuled construction with overhanging bow ends, a feature that reduces the length of the gangway between the vehicles. They are constructed with fireproof floors and are completely encased in steel plating. Each is carried on a massive steel underframe, mounted on pressed steel bogies of an improved design that gives very steady riding.

Although entrance is by means of the end vestibules only, side corridors are incorporated with separate compartments, except in the dining cars. The absence of side doors has made it possible for the windows throughout the train to be of extra large size and they are all of the drop type. Each train is furnished and upholstered in the most attractive manner and has a seating capacity for 84 first class and 364 third class passengers.

Regimental Names for Locomotives

The practice of naming locomotives after famous regiments, as exemplified on many of the "Royal Scots," has been extended on the L.M.S.R. and has now spread to the L.N.E.R. On the former system Nos. 6125, 6147 and 6148 are now named respectively "*3rd Carabinier,*" "*The Northamptonshire Regiment,*" and "*The Manchester Regiment.*" Their former names in the same order were "*Lancashire Witch,*" "*Courier*" and "*Velocipede.*" At a ceremony at Ayr on August 2nd last Lord Trenchard, in his capacity as Colonel of the Royal Scots Fusiliers, presented plaques of the regimental crest to No. 6103, "*Royal Scots Fusilier.*" A regimental party including the band took part in the ceremony.

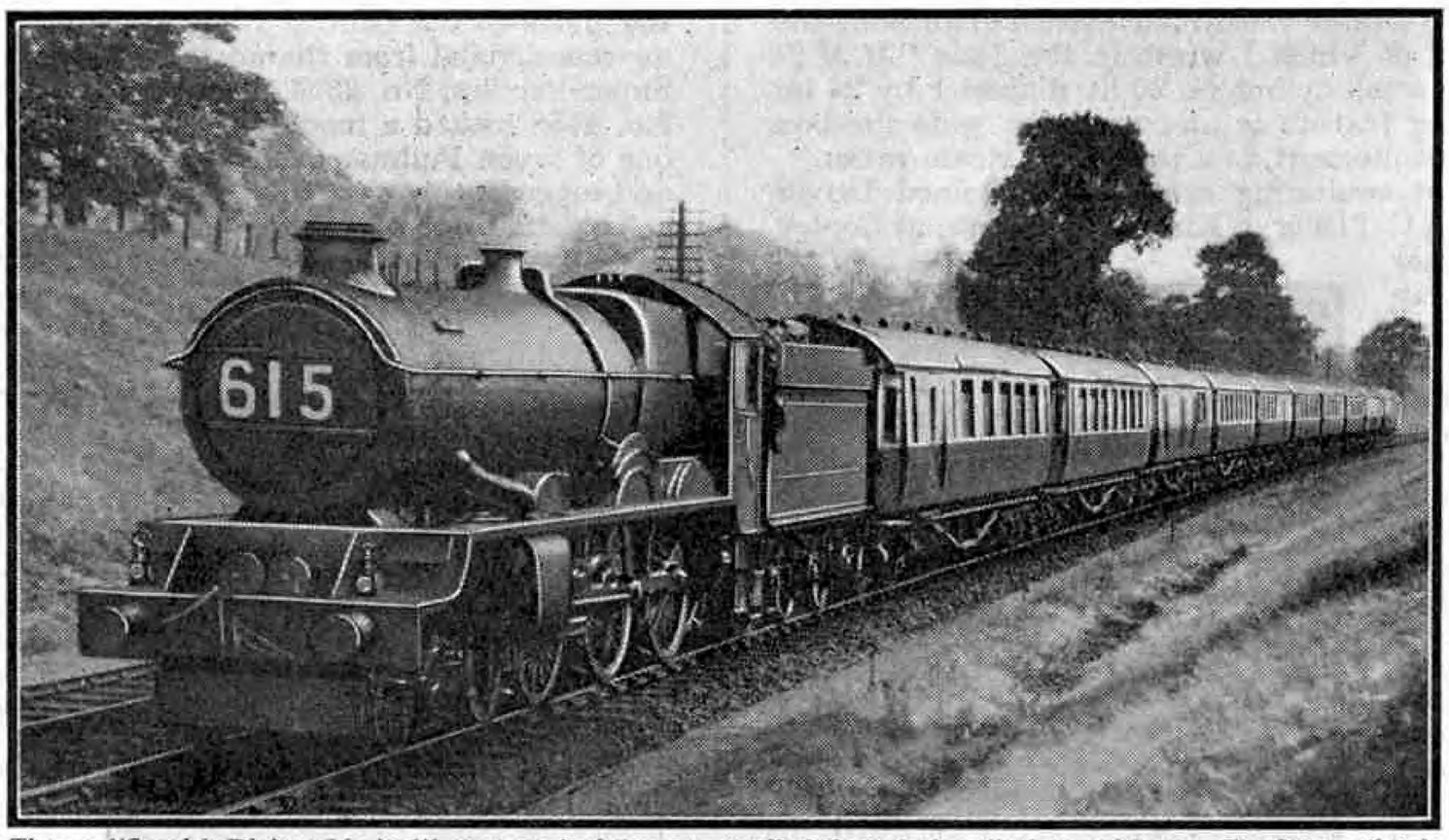
On the L.N.E.R. No. 2845, a new engine of the "Sandringham" class, has been named "*The Suffolk Regiment*" in honour of the 250th anniversary of the formation of that regiment. Major-General Sir John Ponsonby unveiled the nameplates, and placed on the engine plaques bearing the regimental badge. Both driver and fireman were formerly members of the regiment.



Some resemblance to G.W.R. practice is seen in the chimney and smoke-box of this 4–6–4 locomotive, "Lord Baltimore" of the Baltimore and Ohio Railroad. It is intended for special high-speed service. Photograph by courtesy of the Baltimore and Ohio Railroad.

Sound Films on an L.N.E.R. Train

An innovation in railway travel has been arranged by the L.N.E.R. in the shape of a cinematograph van for the purpose of exhibiting sound films. For some time experiments have been made to devise a successful means of exhibiting talking pictures on a train, and an apparatus has now been perfected that enables this to be done successfully. A specially equipped coach with a sloping floor and with theatre seats and talking film apparatus, forms in effect a picture theatre on wheels. This vehicle is attached to the 10.10 a.m. train from King's Cross to Leeds, returning from that city at 3.15 p.m. for London. An attendant announces to passengers the performances that are to be given in the travelling theatre, and a charge of one shilling is made for admission. Each performance lasts approximately one hour.



The up "Cornish Riviera Limited" composed of the new vestibuled stock described on this page. The locomotive is No. 6003, "King George IV," and bears the special train identification number as used on the G.W.R. on Saturdays. Photograph by M. W. Earley, Reading.

L.M.S.R. Dual-Purpose Containers

The L.M.S.R. have recently built at their Earlestown Works 20 insulated containers known as the "F.R." type, for meat or fruit traffic. They are constructed of timber throughout, insulated with "*Alfol,*" an aluminium foil insulator, and fitted with two bunkers for the refrigerant. The containers are so constructed that during the fruit season loose wooden floor grids and frames can be used for packing the fruit baskets. On the completion of such traffic the loose fittings are taken out, and galvanized meat hooks are fitted to the rails, which are allowed to remain permanently in the roof of the container.

The main structural members are of Australian hardwoods. The outer sheeting is of deal boards, and the inner lining of plywood, between which are placed sheets of "Alfol" for insulating purposes. The roof is double, and is insulated in a similar way, as also is the floor. Great care is taken to ensure that the doors are air-tight, and this is achieved by covering their edges with spring-loaded leather sealing strips that are compressed when the doors are closed.

The refrigerating bunkers are arranged for roof loading, and are themselves insulated on all faces except the base, on which are fixed large aluminium cold distribution plates, that are in direct contact with the "dry ice," or solid carbon dioxide, used as a refrigerant. The whole is carried on a specially constructed steel underframe and is equipped with the usual lifting gear. These containers have been designed by Mr. W. A. Stanier, the Chief Mechanical Engineer of the L.M.S.R.

New "Southern Electric" Lines

The train mileage of the services now operating over the latest S.R. electrification to Eastbourne and Hastings shows an increase of 45 per cent over that of the previous steam-operated services. Express trains leave Victoria for Eastbourne and Hastings at 45 min. past each hour. Pullman and buffet cars are attached. The semi-fast and local services are much improved and a special feature is the provision of late trains from London.

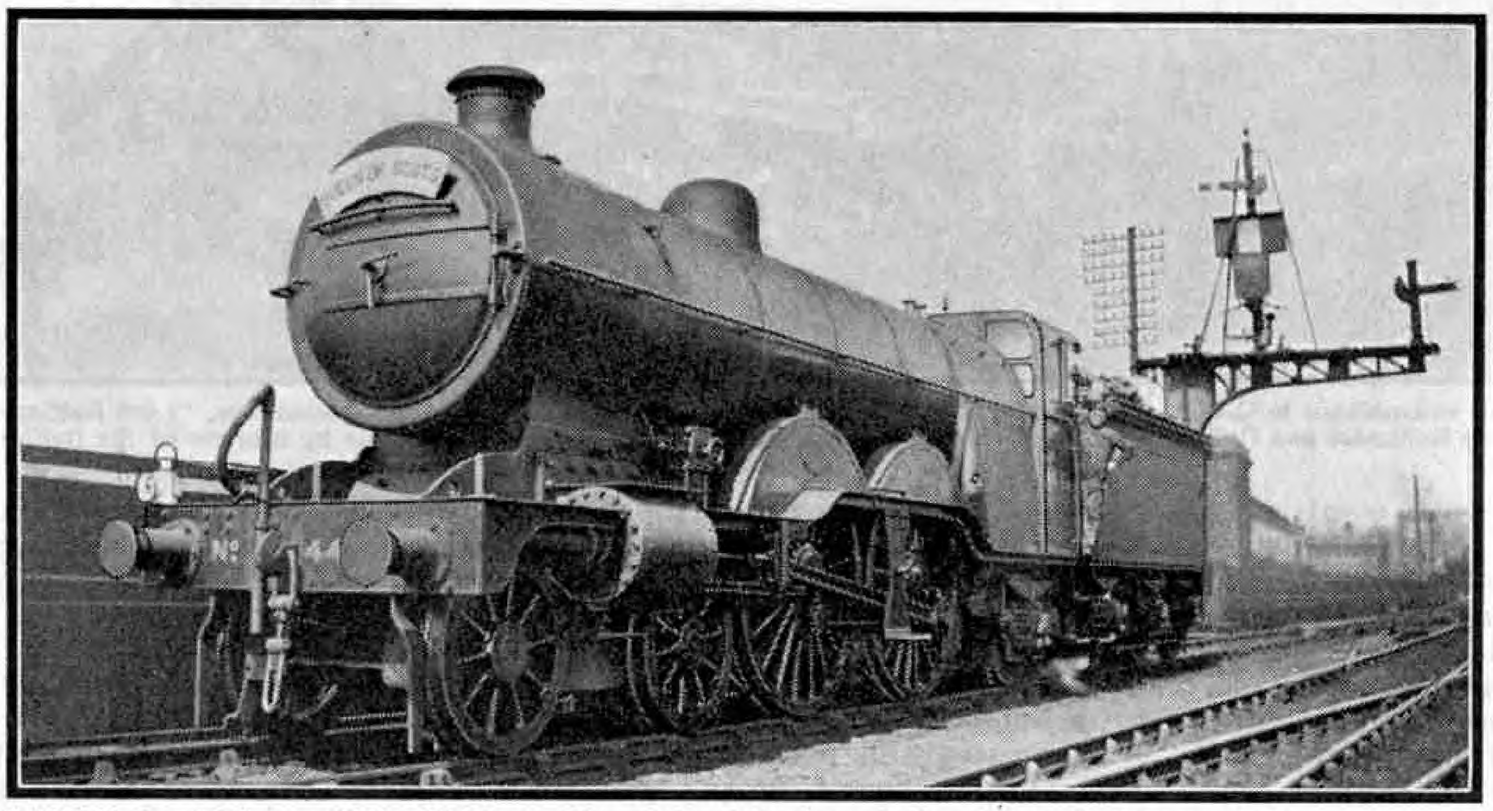
The motor coaches and buffet cars on the new services are fitted with large fixed windows above which are mounted special "air-stream" ventilators.

Footplate Runs on the L.N.E.R.

IV.—The "*Queen of Scots*" Pullman Express

By a Railway Engineer

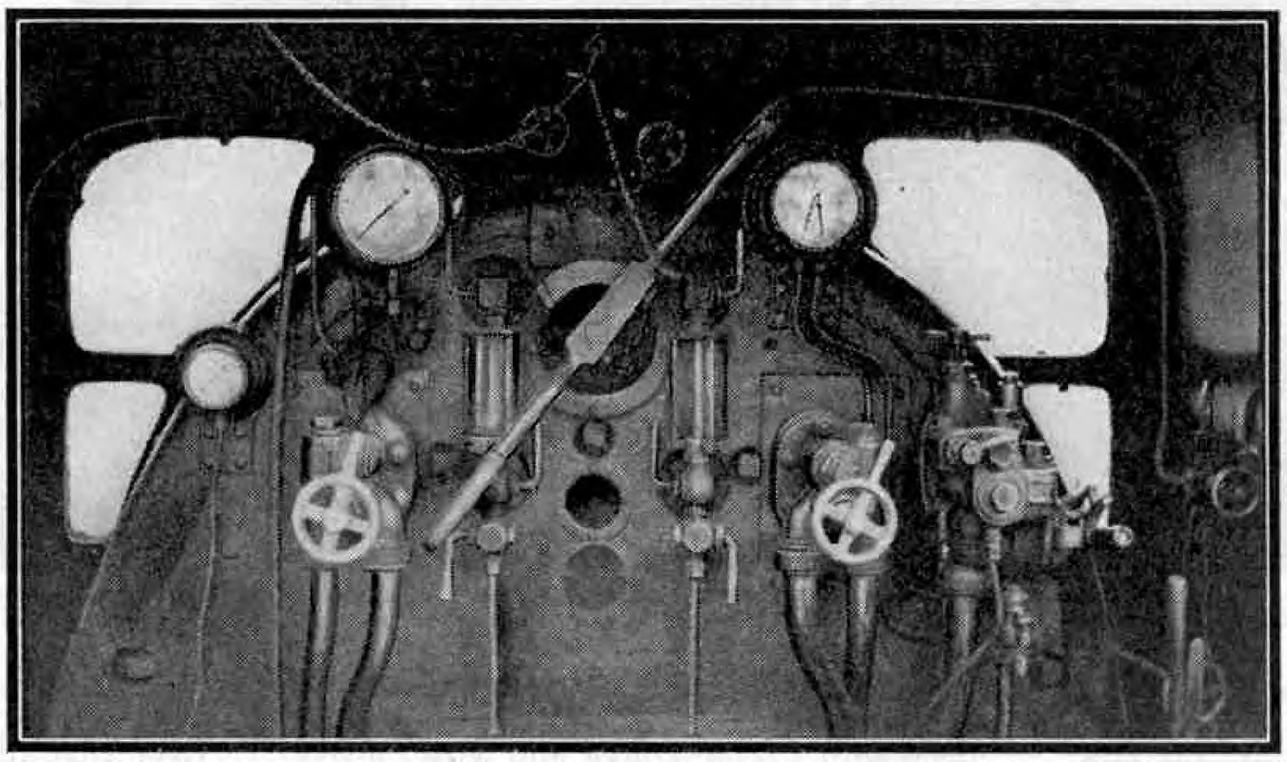
SO far as locomotive power is concerned, the Pullman expresses of the L.N.E.R. enjoy a unique position. The "*Queen of Scots*" is the fastest train of the day between London and Leeds, and yet its haulage is entrusted exclusively to Great Northern "Atlantics." When these crack trains were first put on, the "Pacifics" were not permitted to run over the West Riding line between Doncaster and Leeds, owing to weight restrictions; and the service was worked by G.N. "Atlantics," turn and turn about with Great Central engines, both of the 4–4–0 "Director" class and also of the big 4-cylinder 4–6–0 "Lord Faringdon" type. But now, although the "Pacifics" work regularly over the route, both the "*Queen of Scots*" and the "*West Riding Pullman*" are invariably "Atlantic" hauled.



L.N.E.R. No. 4456, the "Atlantic" locomotive of Great Northern design that made the remarkable run described in this article. Driver Worboys and Fireman Fisher are on the footplate.

It is by sheer merit that these famous engines have retained their place on such first-class work. Not only are they fast and reliable motive power units, but they are also most economical on coal. Unlike the North British engines of the same wheel arrangement, of which I wrote in the June "*M.M.*," they have comparatively small cylinders, 20 in. diameter by 24 in. stroke. Their outstanding feature is of course the wide fire-box which, as we shall see in a moment, is a wonderful steam-raiser.

It was an afternoon of sweltering heat when I joined Driver W. Worboys and Fireman C. Fisher, a King's Cross crew, at Copley Hill sheds, Leeds. Their regular engine was laid up with one of the hundred and one minor troubles that prevent a locomotive from taking the road. A substitute had been hastily requisitioned from Doncaster shed, but on such a crack train as this it is no small handicap to a driver and fireman to have a strange engine. Happily in this case the stranger, No. 4456, turned out to be a grand runner, but Worboys had not fully taken the measure of her until we were over 40 miles from Leeds.



Some of the cab fittings of a G.N. "Atlantic," including the regulator handle, pressure, water and vacuum gauges. The handle of the reversing lever is seen in the right hand corner.

These engines have cabs which, by modern standards, are rather cramped. They are driven from the right-hand side, the reversing gear being of the notched lever type. It is possible for the driver to make much finer adjustment of cut-off than on the North British "Atlantics," on which one notch corresponds to about nine per cent. cut-off. On the Great Northern engines one notch represents about three per cent. The regulator works through a vertical quadrant plate and is provided with a double handle to give more purchase, for it is a stiff job to move the lever when steam is on. Another fitting that is rarely seen nowadays is a long vertical lever, rather reminiscent of a mechanical signal lever, for operating the water pick-up. When released it lets the scoop down with a tremendous clang, and it needs the combined strength of driver and fireman to raise it, when the tender is replenished.

The "*Queen of Scots*" is a hard enough train to work in the ordinary way, timed as it is to cover the 186 miles from Leeds to King's Cross non-stop in 193 minutes, at an average speed of 57.8 m.p.h., but on this trip the task was infinitely harder. Werrington water troughs were under repair, and not only was a 30 m.p.h. slack in force over the site, but as the troughs themselves were empty we had to stop at Peterborough to take water, for we dared not risk running through from Muskham to Langley, 96 miles, without replenishment. The driver estimated that this check would cost us ten to eleven minutes in running time.

Soon after 3.30 p.m. we "whistled up," and backed down from the sheds to the Central station. Dead on time, at 3.57 p.m., the express arrived from the north in charge of one of the very latest Super-Pacifics, No. 2504, "*Sandwich.*" Alongside this huge engine, No. 4456 looked a modest engine indeed. The load was the usual one of seven Pullmans, 277 tons tare and 290 tons with passengers and luggage.

The start out of Leeds is exceedingly difficult. Right from the platform end comes half a mile at 1 in 100 to Holbeck, and just beyond that station there is ⅝ths of a mile at 1 in 50. A mile of favourable grade follows, and then comes a 3-mile bank, continuously at 1 in 100, to Ardsley. It was a minute after time when we got the right-away. Worboys started off with 66 per cent. cut-off, the regulator being gradually opened to one-half. At Holbeck the L.N.E.R. line crosses the L.M.S.R. (Midland Division) main line to Carlisle, and on the viaduct we passed right over the 4.0 p.m. Scotch express, which was getting away in good style with a Stanier 3-cylinder 4–6–0 at its head.

Once up the 1 in 50 grade the regulator was opened up to the full, and cut-off reduced to 50 per cent. We quickly reached 43 m.p.h. and then tackled the Ardsley bank. The footplate end of the engine swung from side to side under the thrust of the pistons, the noise of the exhaust was tremendous, and speed settled down to a steady 39 m.p.h. This was most exceptional climbing; many a time I have travelled as a passenger on this train, and even on the finest runs speed is rarely maintained at more than 30 m.p.h. here. Ardsley summit,

5½ miles out, was passed in 10¾ minutes, and with moderate speed down the subsequent winding descent we were through Wakefield, 9.9 miles, in the remarkable time of 15¾ minutes, a gain of 2¼ minutes on schedule.

Recovering from the 25 m.p.h. slack over the junctions here, and working on 35 per cent. cut-off with the regulator half open, speed was picked up in lightning fashion. At Sandal, 1¾ miles farther on, we were doing 59 m.p.h. and the four miles at 1 in 150-180 to Nostell were mounted at a minimum speed of 50 m.p.h. Now the regulator was closed to one-fifth open for a simply hectic descent towards Doncaster. The G.N. "Atlantics" are rough-riding engines at the best of times, but No. 4456 excelled in this respect. She pitched, she tossed and then developed an extraordinary corkscrew sort of motion. As we dashed down past South Elmshall and Hampole at 75-76 m.p.h. I was reminded of Harold Monros' lines:

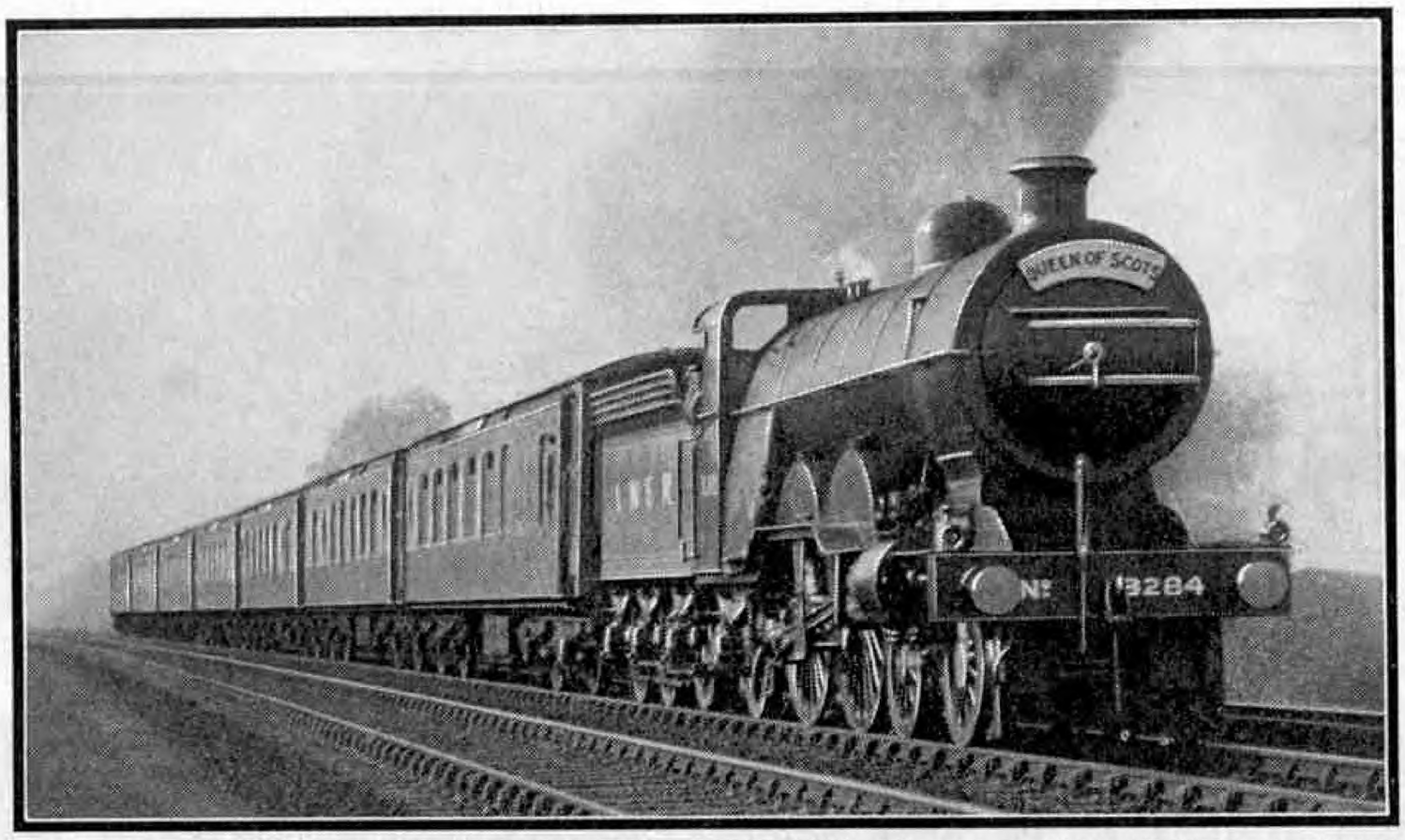
"Oh, the wild engine! Every time I sit
"In any train I must remember it.
"The way it smashes through the air; its great
"Petulant majesty and terrible rate:
"Driving the ground before it, with those round
"Feet pounding, eating, covering the ground . . ."

"Wild" perfectly describes No. 4456's behaviour at high speed! Lest any readers should be chary of travelling behind G.N. "Atlantics" in future, however, I should add that the rough riding of this engine, in common with all others of the type, was almost entirely confined to the cab end. Looking forward, the leading end was noticeably steady, and I hardly need add that the engines are absolutely safe at the very highest speeds. Riding on their footplates, however, is an enlivening experience!

Approaching Doncaster we got signals "on" badly. The West Riding line comes in on a sharp curve at Marshgate Junction, and whereas the East Coast expresses proper can pass Doncaster at full speed, the "Pullmans" have a 25 m.p.h. slack, so that the check did not cost more than ½ minute, and we passed Doncaster 29¾ miles in 36 minutes—3 minutes under schedule.

Speed was regained well from the slack, but the driver eased very pronouncedly at Scrooby in order to pick up as much water as possible from the troughs. Now the engine was fairly opened out. From this point there is a gentle rise as far as Retford, and then comes Askham bank, 5 miles at 1 in 200. Accelerating magnificently, we passed Retford at 73 m.p.h., and took the stiff rise beyond without speed falling below 60 m.p.h. (!), while from the summit we raced away in such style that the pace through Tuxford, only two miles beyond, was 74 m.p.h. Now the regulator was brought back to one-fifth open but continuing down the fall to the Trent Valley speed steadily rose until we swung through Crow Park at 82 m.p.h., the engine riding wilder than ever.

Across the level stretch towards Newark, on such a narrow regulator opening, speed fell off considerably, and at Muskham troughs we were going only just over 60 m.p.h., but on passing Newark the driver once again opened out to half regulator. The engine responded with one of the most phenomenal pieces of running I have ever witnessed. From Newark there are 20 miles of continuous climbing to Stoke summit. At first the grades are fairly easy, varying between 1 in 300 and 1 in 500; but then come 2 miles at 1 in 200 to the north end of Peascliffe tunnel. Accelerating in amazing fashion to 68 m.p.h. at Claypole, speed fell off very little as the rise steepened, and we entered the tunnel at 58 m.p.h. In the darkness could be seen thousands of red-hot cinders being spat from the chimney; they hit the roof and rebounded in a brilliant shower over the cab. Once through the tunnel there are two miles of easier grade before Grantham, and we approached this important centre at 64 m.p.h.

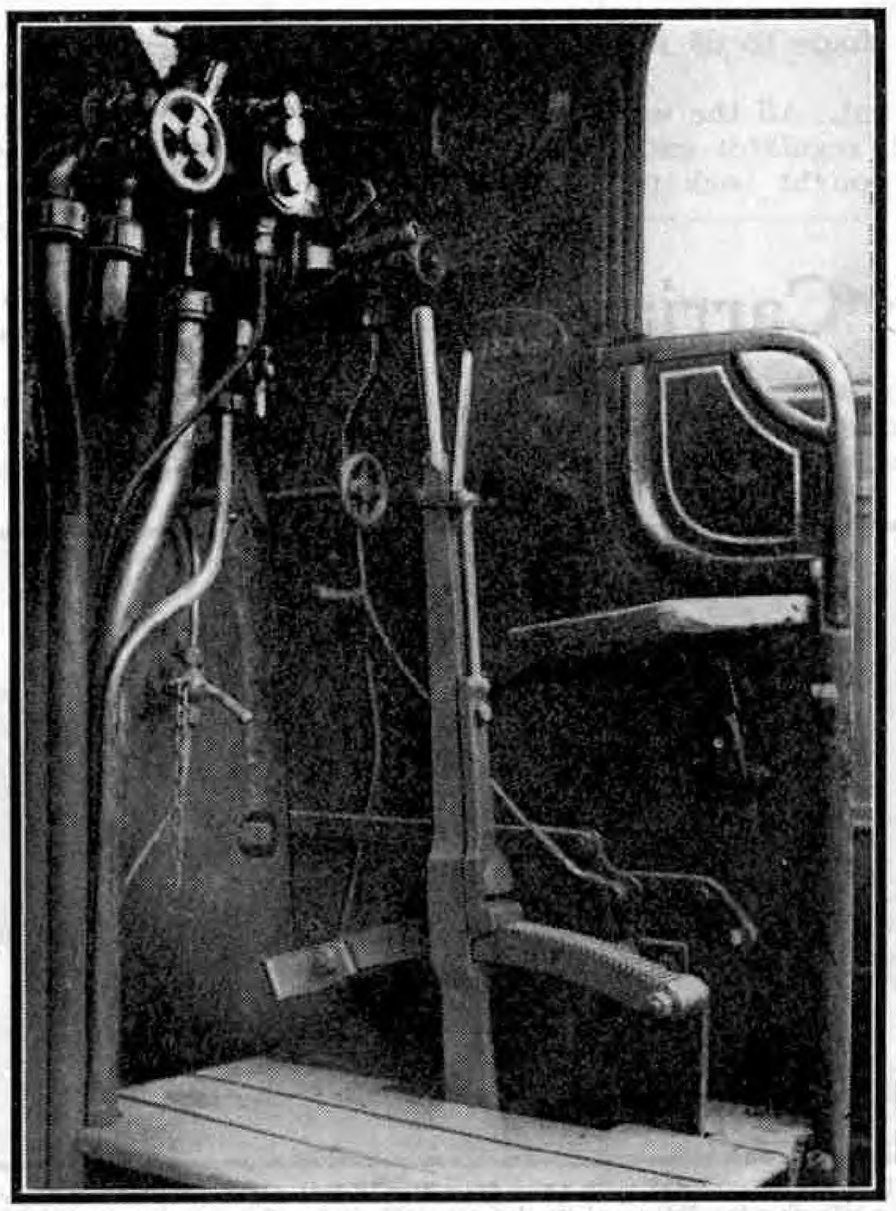


The "Queen of Scots" Pullman hauled by G.N. "Atlantic" No. 3284. The cars are of the all-steel type now run on this train. Photograph by courtesy of the L.N.E.R.

The 80¼ miles from Leeds had taken 83½ minutes, instead of the 88 minutes allowed; while the 50½ miles from Doncaster had been run in 47½ minutes. Now we were launched on the final ascent to Stoke, 5½ miles continuously at 1 in 200. Still going on half regulator and 35 per cent. cut-off, speed was splendidly sustained and we came over the summit at 55 m.p.h. The 20 miles of climbing from Newark had been run at an average speed of 61.3 m.p.h.

As we commenced the long descent to Peterborough I was astonished to see not the slightest easing of the engine take place, and the resulting acceleration was positively uncanny. Passing Corby, 3 miles from the top, at 77½ m.p.h., speed soared through the "eighties" until, approaching Little Bytham, we were doing 90, and three miles beyond we reached the terrific maximum of 93 m.p.h.! Strangely enough, at this pace the engine rode more smoothly than at any other point in the journey, and after the tempestuous descents earlier in the run the sensation on the footplate was very mild. But apart from this, the experience was thrilling beyond words. Although beyond Essendine the grades flatten out into almost dead level, the speed was sustained at an amazing figure. For 10¼ miles, the average was 90.3 m.p.h., and when steam was at last shut off for the Werrington permanent way slack we were still doing 88 m.p.h.

Although we did not approach the great record of the Pacific *"Papyrus,"* Driver Worboys attained the highest speed ever known with an "Atlantic," and despite the great difference in tractive power, No. 4456 was being worked no harder than *"Papyrus."* The latter had ⅝ths regulator and 32 per cent. cut-off and "4456" was running on half regulator and 35 per cent. cut-off; yet while the "Pacific" hauling 217 tons reached 108 m.p.h., we got up to 93 hauling the much heavier train of 290 tons. It was a very wonderful demonstration of "Atlantic" ability.

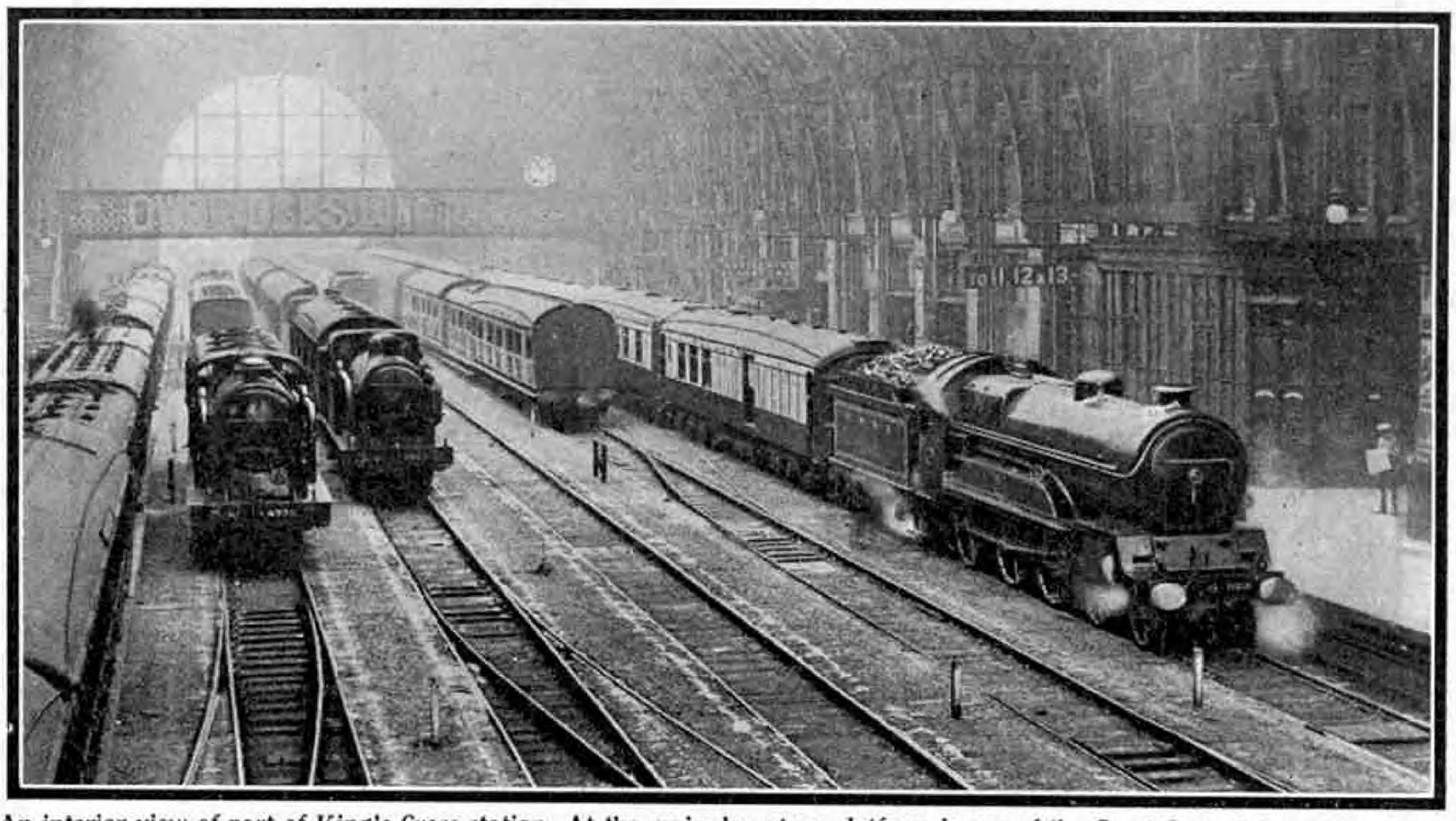


The driver's side of a G.N. "Atlantic." This photograph, in conjunction with the lower one on the previous page, gives a good idea of the cab arrangements.

The result of this magnificent running was that we stopped at Peterborough, 109½ miles from Leeds, in 109¾ minutes, or 107 minutes net. The train is booked to pass through in 117 minutes, so that we had already gained 10 minutes! Taking water occupied five minutes of precious time, but while this was in progress the driver took the opportunity of going round the engine

thoroughly. Despite the great pace at which we had been running, all bearings were perfectly cool and the engine was in first-rate order and ready for a further burst of high speed.

We got away again in dashing style, but it was soon clear that we needed every second of the time we had gained to Peterborough, for notwithstanding a fine restart we were only just on time at Huntingdon. We passed this station at 79 m.p.h., and beyond Offord, where the line is slightly against the engine, we kept up 70-75 m.p.h. without intermission. Despite this continuous hard running there was no flagging whatever in the engine's effort. It was on this length that the steaming was so noticeably free. Fisher's method of firing was to keep a thick fire just under the door and to allow it to shake forward to cover the whole grate. In this way the engine never once emitted black smoke from the chimney, while the coal consumption was less than 40 lb. per mile, a tribute to the efficient management of the crew.



An interior view of part of King's Cross station. At the main departure platform is one of the Great Central 4-cylinder 4–6–0 engines at the head of the "Harrogate and Edinburgh Pullman" train, as the "Queen of Scots" was formerly known.

Passing Three Counties at 69 m.p.h., we were in fine trim for the long ascent to Stevenage; and at Hitchin, nearly half way up, the speed was still as high as 62½ m.p.h. We were getting comfortably ahead of time now, having run the 27 miles from Huntingdon to Hitchin in the splendid time of 23 minutes, an average of 70.5 m.p.h., despite the rising character of the line. At Stevenage summit speed was 53½ m.p.h., and far from being "winded" by the 7-mile climb, a brilliant recovery was made to 65 m.p.h. at Langley troughs barely 2 miles further on.

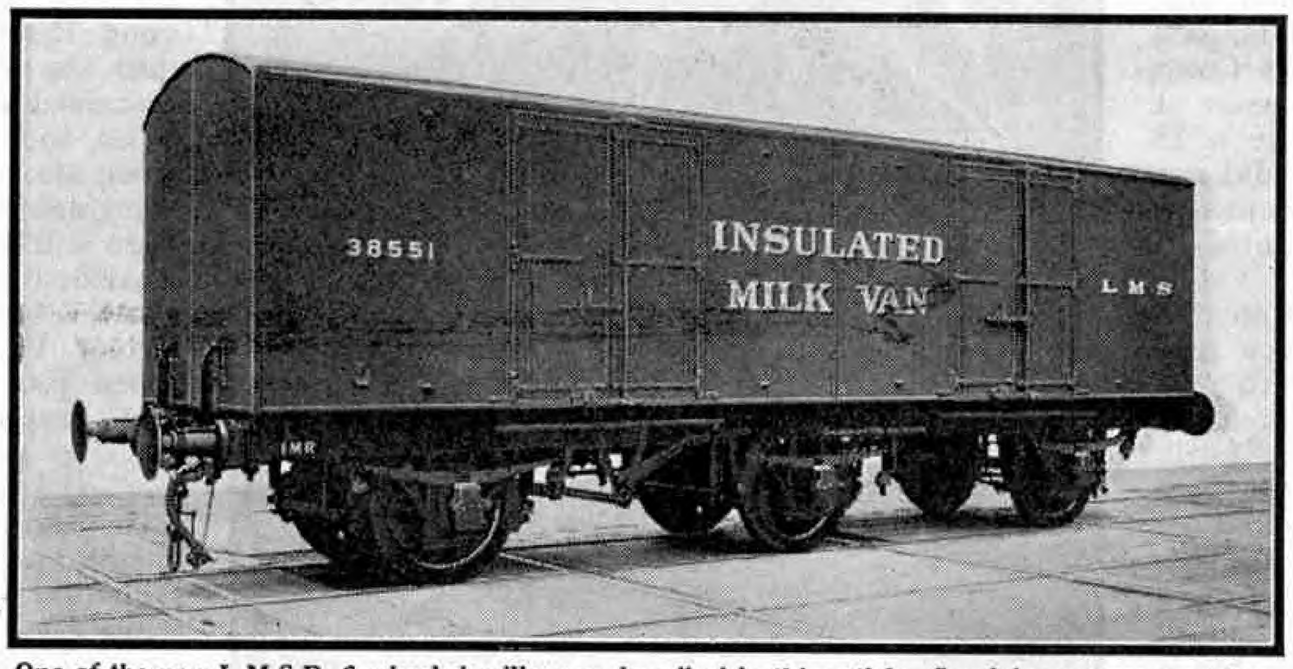
At Knebworth the engine was at last eased. All the way from Peterborough we had been working on half regulator and 35 per cent. cut-off, but now the regulator was brought back to about two-fifths open. We dashed down through Hatfield at 82 m.p.h.—we were running four minutes early here—and simply stormed up the 5-mile rise to Potters Bar; the summit here was passed at the amazing minimum speed of 69 m.p.h.! Now, for the final descent into London, the regulator was brought right back to one-fifth open. We passed Barnet at 74, but here, although we were still 9 miles from the terminus, Worboys shut off steam altogether. So we finished quietly, but for all that passed Finsbury Park, 73¾ miles from the fresh start at Peterborough, in 69 minutes.

With excellent prospects of an arrival at King's Cross five minutes early, we most unfortunately got signals badly "on" at Holloway. Nevertheless we got through without a dead stand, and stopped triumphantly in King's Cross at 7.12½ p.m.—2½ minutes early. We had thus run the 186 miles from Leeds in 189½ minutes inclusive of all delays. It is when careful allowance is made for the various checks, however, that the really astounding nature of the run is revealed, for the net time works out at 176 minutes—a gain of 17 minutes on booked time! This gives a net average speed of 63.3 m.p.h. from Leeds to London.

Further comment on this superb run seems superfluous, I might add, however, that time regaining of this kind is not uncommon on the Pullman trains. The very same day, the corresponding down express gained 11 minutes net between London and Leeds. On the journey just described, however, Driver Worboys and Fireman Fisher set up a record that will take a lot of beating, and I count myself extremely fortunate to have been privileged to ride with them on so auspicious an occasion.

The Carriage of Milk by Rail

THE carriage of milk has long been an important feature of the traffic carried by the railways. Every reader is familiar not only with the sight of milk churns on the local station platform, but also with the cheerful rumble that they make when trundled along empty. Porters at stations where a large milk traffic is dealt with become very expert at handling the churns and find no difficulty in trundling two empty churns along the platform at once. But such tricks cannot be done with full ones! A standard churn holds about 17 gallons, but apart from the weight thus involved, milk must not be treated roughly in transit or it will be spoiled.



One of the new L.M.S.R. 6-wheeled milk vans described in this article. Special measures are taken to ensure the effective insulation of the interior. Photograph by courtesy of the L.M.S.R.

The vehicles used for milk traffic are frequently of the covered ventilated type, sometimes with open-boarded sides to keep a current of air circulating round the churns inside them. Some lines also have ventilated vans of "coach-built" rather than "wagon" construction, that are used for milk, and sometimes for parcels and other traffic. Although all these types are ventilated, their interiors are not independent of the variations of atmospheric temperature.

The L.M.S.R. have built at Derby recently two interesting milk vans of an improved type. With a view to providing the greatest possible protection of the milk from the effects of outside temperature, these vans incorporate special features of insulated construction. Their outside dimensions are 31 ft. long by 8 ft. wide, and they are mounted on steel underframes of the design standard for 6-wheeled carriage stock. There are two pairs of insulated double doors on each side, fitted with cam-action fasteners and sealed joints.

The cooling apparatus inside the vans consists of six wet ice bunkers, three on each side. There are also three "Drikold" bunkers to contain solid carbon dioxide, fitted close up to the ceiling, the interiors being connected by galvanized pipes and brass outlets to the insulation space in the body side and ends. The special construction of the body framework permits a complete circulation and allows the air in the insulating spaces to come in contact with the cooling gas, thus further assisting the insulation.

A development of recent years in the transport of milk in bulk, has been the use of insulated milk tank wagons. Some of the tanks are road-rail vehicles that can be run by road to the railway from the dairy farms and then loaded on to flat wagons specially made to receive them.

Cutting Narrow Trenches for Small Pipes

An Effective Excavating Mechanism

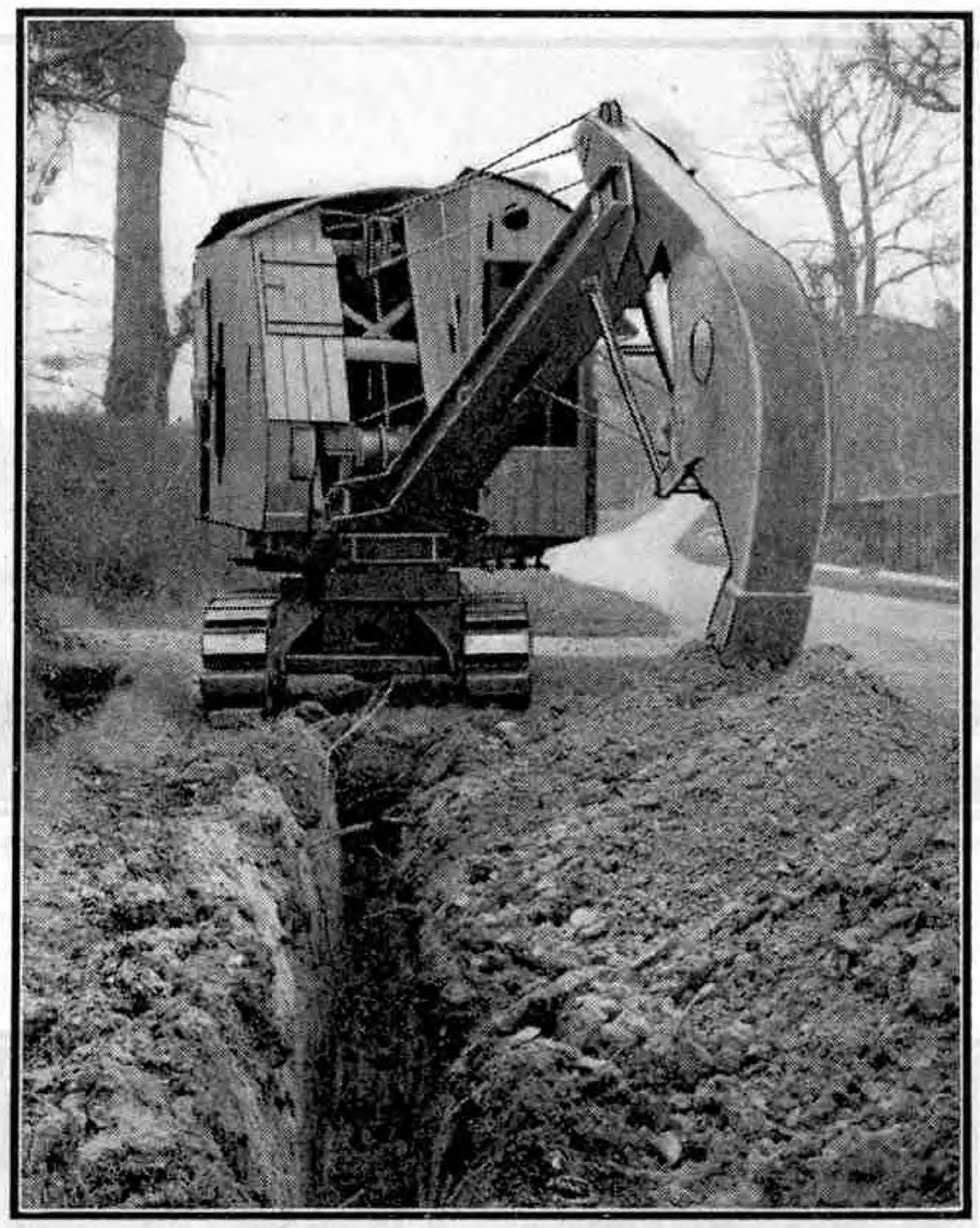
BEFORE excavating machinery was introduced, tasks such as cutting canals, digging reservoirs and sinking the deep foundations of large buildings, were carried out slowly and laboriously by the combined efforts of large numbers of men. During comparatively recent years this manual labour has been replaced gradually by mechanical power, and the greater part of the excavation in these great undertakings is now done by machines of various types.

The earliest mechanical excavators were simply huge digging machines capable of taking great bites out of the earth. One of the most familiar of such machines is the steam shovel, sometimes referred to as the steam navvy. This consists of a huge shovel mounted on the end of a powerful steel arm or jib, and operated by a steam engine housed in a cab resembling that of a breakdown crane. Steam shovels are capable of doing an enormous amount of work, and are to be found wherever large-scale excavation is in progress. At the same time their scope is limited, for they cannot excavate material below their own level, and they are unfit for use on wet or marshy ground.

Where the existing conditions make a steam shovel unsuitable, its place may be taken by another mechanical digger, known as the dragline excavator. This machine gets its name from the fact that its bucket or shovel is dragged towards the machine on a flexible rope, instead of being mounted on an arm that pivots on a jib, as is the case with the steam shovel. The main difference between the steam shovel and the dragline lies in the method of working. The steam shovel excavates above the level on which it stands, it works away from itself, and it advances into the excavation as the work proceeds. The dragline does exactly the opposite. It excavates below the level on which it stands, it works towards itself, and it travels backward when it has excavated all the material within reach. Even these two machines, valuable as they are, cannot deal with all kinds of work, and other machines for carrying out excavation work of various special types have been produced.

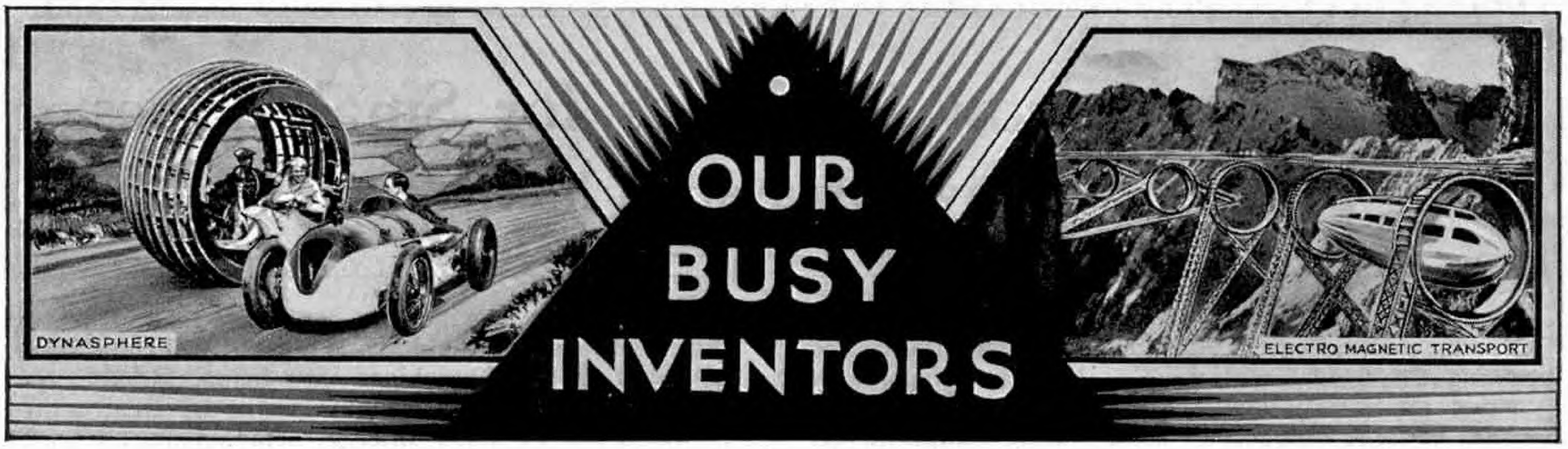
The disadvantage of having to use a separate machine for each class of work became more serious as mechanical excavation became more general. The obvious solution to the problem was a machine capable of tackling a great variety of jobs, and the skill and ingenuity of the engineer has brought such machines into being. Briefly, they may be said to consist of a main power-driven structure, to which can be fitted different attachments for use in different circumstances.

An interesting machine of this type is the "Cub" lightweight excavator introduced by Priestman Brothers Ltd., of Hull, some three years ago. This excavator has a scoop capacity of $\frac{1}{4}$ cu. yd., and a total weight in full working order on creeper tracks of just under 7 tons. The "Cub" can be fitted with seven different attachments. There are dragline and grab attachments that are designed mainly for drainage work, but have other auxiliary uses in gravel pits, brickworks, quarries, etc. The machine is quickly convertible for operating either as a pile driver or crane, and it has three attachments specially designed for the use of builders and contractors. These are the navvy shovel for excavating from a 15-ft. vertical face; the trench shovel for digging trenches from 2 ft. to 2 ft. 6 in. wide and 12 ft. deep for the laying of sewers, etc., and the skimmer scoop for grading work in connection with the preparation of new roads, and also for removing overburden in gravel pits and brickworks.



The Priestman "Cub" excavator with "Teredo" attachment for cutting narrow trenches. Photograph by courtesy of Priestman Brothers Ltd.

Recently it was found that there was a demand for a means of cutting narrow trenches for the laying of cables and small pipes of about 3 in. or 6 in. diameter, and this demand has resulted in the introduction of a new attachment for the "Cub." It is named, appropriately enough, after the *Teredo*, which is a worm about 3 ft. long that burrows and lives in long cylindrical holes excavated in the timbers of ships, the woodwork of harbours and elsewhere. In average materials the "Cub" with Teredo attachment will dig down to a depth of as much as 8 ft., although as a rule it is sufficient to give a cover of 3 ft. to a 3 in. or 6 in. pipe, making a total depth of trench of less than 4 ft. In normal excavating conditions in open fields, outputs of up to 250 lineal yards per 8-hour day have been reached when working on trenches 1 ft. wide by 4 ft. deep. On an ordinary grass verge of reasonable width running alongside a main roadway, 200 lineal yards per day is an average progress on a trench of similar dimensions.



By P. A. Tent

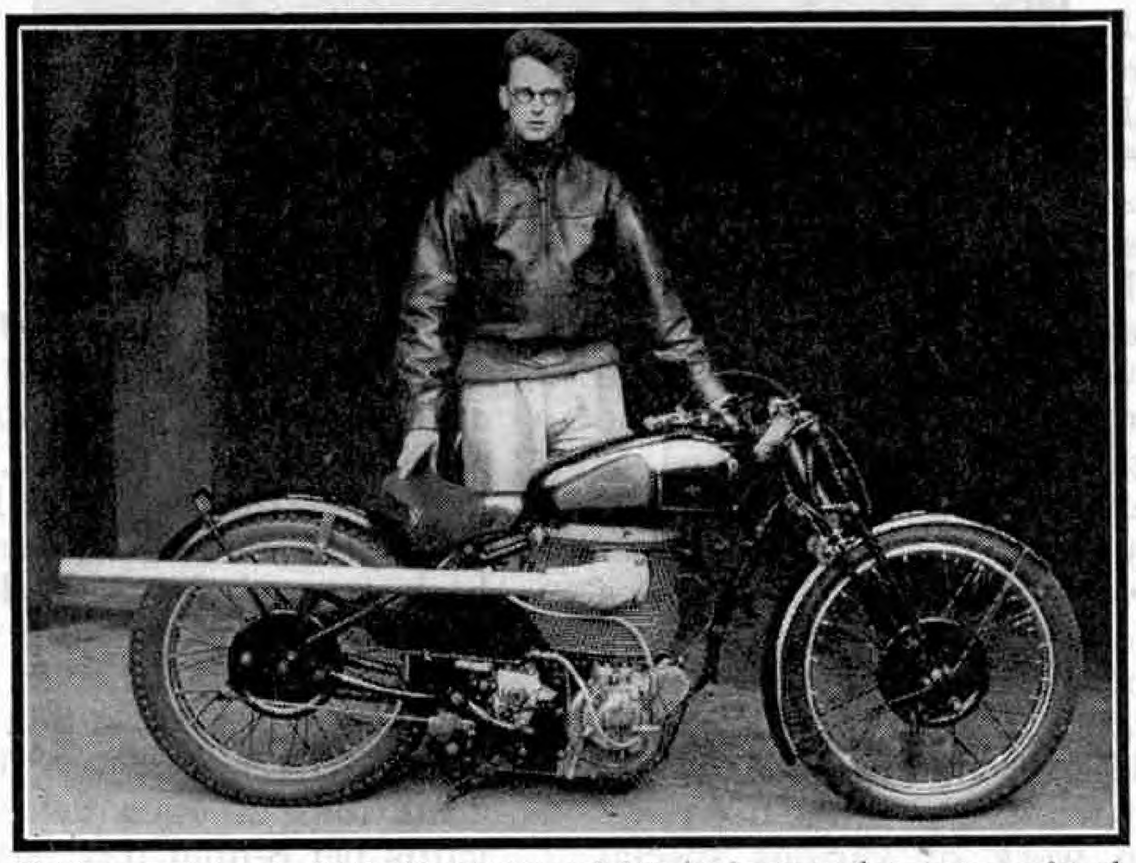
Profits of Invention

In the May issue of the *"M.M."* I commented on the increasing industry of British inventors, as shown by the fact that in 1934 Great Britain was the only great country in which there was a substantial increase in the number of patent applications registered in comparison with the previous year. The fees paid by British inventors last year amounted to no less than £540,780, and there actually was a profit of £212,711. It may be satisfactory in some respects to reflect that this profit was nearly £39,000 more than that of the previous year, but it seems a short-sighted policy to make so much money out of the activities of inventors, for national progress is largely dependent on invention and its application in industry, and this cannot be too strongly encouraged.



The frog rammer in action. It weighs half a ton and jumps into the air as it delivers its blows. Photograph by courtesy of C. H. Johnson and Sons Ltd., Manchester.

The report of the Patent Office for 1934 reveals that the great spurt in chemical invention that was noted in 1933 was maintained. Special attention seems to have been given to the production of motor spirit and lubricating oils by various methods from such primary materials as coal, and to the development of fabrics loaded with artificial resins to make them uncrushable. Other directions in which inventors have been active include the production of devices to help in the road safety campaign, and to make our mines safer. Paper and cardboard containers for milk and other liquids also have been introduced, and the long reign of paper as a wrapping material is threatened by the appearance of a transparent film made from cellulose products. One interesting invention that will appeal to the economist is a combination of a cooking stove and a refrigerator, in which the waste heat of the former provides the energy required by the latter!



The Cross motor cycle, fitted with a water-cooled engine incorporating a rotary valve of original design. Oil jets are employed to cool the underside of the piston.

Needless to say, the flow of electrical devices continues, and in these the cathode ray tube figures largely, as would be expected in view of its application to television, which is now a centre of keen interest. The beam of electrons produced in a cathode ray tube is practically weightless and responds instantly to electrostatic and magnetic influences. Its movement can be followed readily by allowing it to fall upon a surface covered with certain chemicals that glow when it strikes them, and for this reason it makes a valuable pointer for an indicator.

Probing Secrets of Petrol and Oil Engines

Inventors would do well to keep the cathode ray tube in mind in connection with indicating devices of all kinds. What can be done in this respect is shown by the introduction of the Metrovick-Dodds Indicator, in which its beam is used to trace pressure and other changes in the cylinders of internal combustion engines. Indicators of the type used in steam engines usually are too slow in action to give satisfactory results with petrol or oil engines, but the new instrument is ideal for this purpose and will help to solve many of the problems that yet confront designers of internal combustion engines. In the device a plug fitting, inserted in the cylinder head of the engine under test, transmits pressure variations to a carbon resistance, and changes in this affect in turn the flow of current to the controlling electrodes of a cathode ray tube. The beam of electrons in the tube follows these variations instantly, and its movement on the fluorescent screen can be watched or photographed. A timing device enables any desired part of the movement to be magnified for closer inspection.

Fresh Water from the Ocean

The Metrovick-Dodds Indicator is an excellent example of the manner in which pure science comes to the aid of the engineer and industrialist. Only a short time ago the cathode ray tube was little more than a scientific curiosity, but it is now being turned to practical use. The beginnings of a similar progress, this time in connection with a chemical discovery, were perhaps to be seen at the Conversazione of the Royal Society held in May of this year, where great interest was taken in four tubes that were achieving the miracle of transforming sea water flowing through them into good drinking water. The first and third tubes contained resins, prepared from tannin

materials, that retained the sodium and other metallic contents of the sea water; and the others were packed with aniline resins, the purpose of which was to remove the acidic constituents combined with them.

This interesting application of resins has been developed by the Department of Scientific and Industrial Research, a Government institution. The synthetic resins used can be produced cheaply, and eventually the process may be developed so far that all the drinking water required on a long voyage will be obtained from the ocean itself, and it will no longer be necessary for ships to devote valuable space to fresh-water tanks.

Safety Bumpers for Motor Vehicles

I have already pointed out that inventors are particularly active in the production of devices to increase road safety, and a new safety bumper for fitting to motor vehicles promises to be exceptionally valuable in this respect. The majority of deaths caused by motor cars or lorries are due to crushing under the wheels, and the new bumper, invented by Dr. Vernon J. Clifford, has been designed to prevent fatalities of this kind. It takes the form of two rollers, each about 3 in. in diameter, that are mounted one above the other in front of the vehicle. When any object is encountered, the force of the impact is reduced by a leaf spring and dampers on the frame carrying the rollers. These are rotated in the opposite direction to the wheels by means of a starter motor driven from the accumulator fitted to the vehicle, their backward movement closing the necessary switch. The result is that the obstacle is rolled along the road instead of being run over.



The "Safety Bumper" rolling a man along the ground after he has thrown himself in front of a 3-ton truck. Photograph by courtesy of Safety Bumpers Ltd., London.

As a supreme test of efficiency, a man actually threw himself in front of a 3-ton Commer truck of the Vacuum Oil Company Ltd., that has been fitted with the device for test purposes, as shown in the upper photograph on this page. The truck was travelling at from 12 to 15 m.p.h., but the only injury the man received was a slight bruise, and it is uncertain whether this was due to the fall on the road or to a blow from the bumper. In the absence of the safety bumpers he would have been crushed and severely injured. This test seems to me to prove the value of the invention, for most accidents in which pedestrians are run down by motor vehicles occur in congested areas, where speeds usually do not greatly exceed 15 m.p.h. It should be equally valuable where higher speeds are attained, however, for tests with dummies in these conditions have been equally satisfactory.

Rammer that Jumps like a Frog

There are many occasions when loosely packed earth or other material has to be firmly consolidated, and this can now be done in an interesting manner by means of the frog rammer shown in the upper illustration on the opposite page. Although this tool weighs half a ton, it actually jumps a foot or more into the air when it is at work, and delivers 50 or 60 heavy blows a minute, moving forward in a series of frog-like jumps of 6 in. to 8 in.

The frog rammer is really an internal combustion engine, with a water-jacketed cylinder set on a wedge-shaped foot that inclines it forward. Benzole is the fuel used and the battery and ignition coil are carried in a box on the back of the worker handling the rammer. Each explosion forces the foot of the rammer into the soil, and also acts upward on a special piston to cause the curious jump. The tool is valuable in making embankments for railways, roads and reservoirs, and also for consolidating refuse heaps.

A Novel Motor Cycle Engine

The lower illustration on the opposite page shows a motor cycle fitted with an engine incorporating a rotary valve of original design instead of the usual mushroom type. This engine was designed by Mr. R. C. Cross, a Bath motor engineer. The valve itself is cylindrical, with spiral recesses cut on it so that the inlet and exhaust valves are successively uncovered as it rotates. The cylinder is water jacketed, and internal fins on the cylinder head help to remove the heat; and another excellent feature is that oil jets cool the underside of the piston.

The Cross motor cycle was entered in this year's T.T. races in the Isle of Man. Owing to unfortunate circumstances its rider had not become familiar with its peculiarities, however, and a cracked exhaust casting compelled its retirement. In other trials a 500-c.c. motor cycle fitted with the Cross engine has exceeded 100 m.p.h. The new valve can of course be applied to motor car engines.



A modern gas cooker of streamline form. This is a replica of the cooker installed in the King's House. Photograph by courtesy of the British Commercial Gas Association.

Gas and the Inventor

The lower illustration on this page shows a replica of the gas cooker fitted in the King's House. This is double, with a gas-heated compartment between the two ovens, and is finished in enamel, stainless steel and bakelite. In accordance with modern ideas, it is "streamlined" and has no visible piping. The taps are self-lighting, and there are special grease traps to catch any liquid that is spilled. Other interesting features are drop doors to the ovens that form shelves when opened.

The illustration will perhaps serve as a reminder of the immense advances that have been made in gas engineering during the last few years, and also as an indication of the immense field that the use of gas opens to the inventor. The trend to-day is to make gas appliances automatic. Most readers no doubt are familiar with the gas match, the jet of which is drawn smartly across a rough surface, when a spark from a flint ignites the gas. Replacing the fitting in its bracket automatically turns out the light.

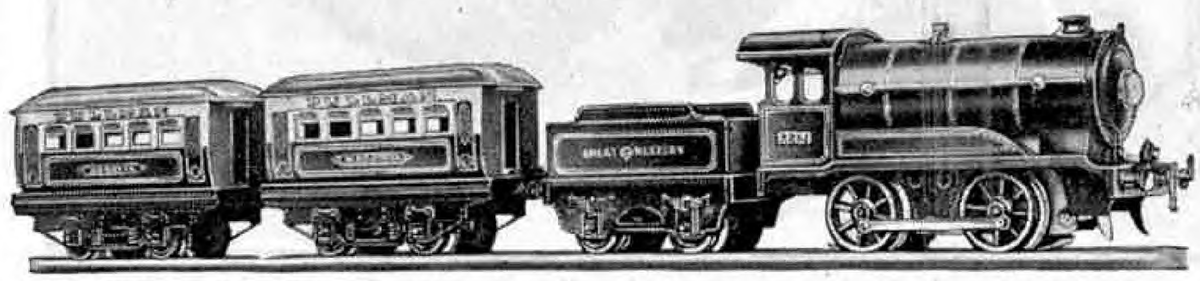
HORNBY ELECTRIC TRAIN SETS



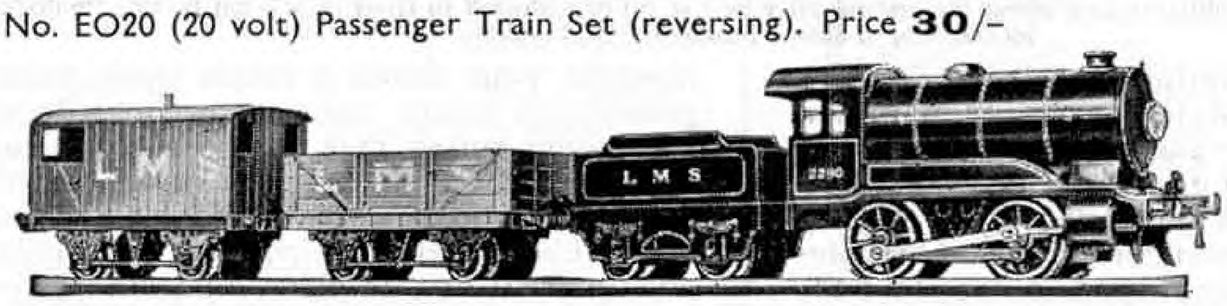
EM120 (20 volt) or EM16 (6 volt) Goods Train Set (non-reversing). Price **15/–**



EM320 (20 volt) or EM36 (6 volt) Tank Goods Train Set (reversing). Price **24/–**



Hornby No. EO20 (20 volt) Passenger Train Set (reversing). Price **30/–**



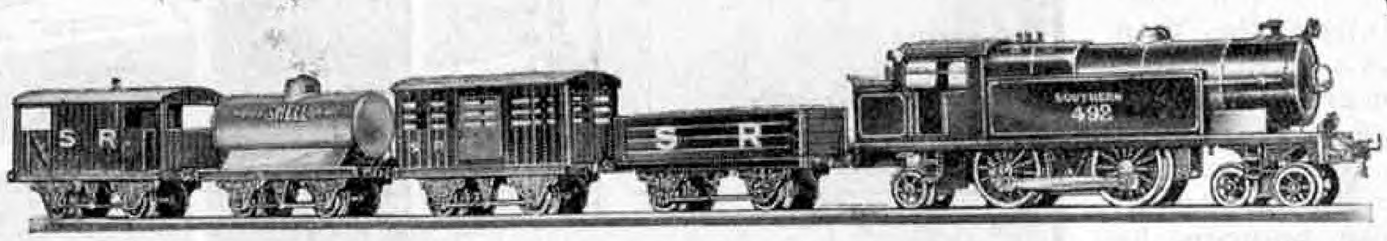
Hornby No. E120 (20 volt) Goods Train Set (reversing). Price **36/–**



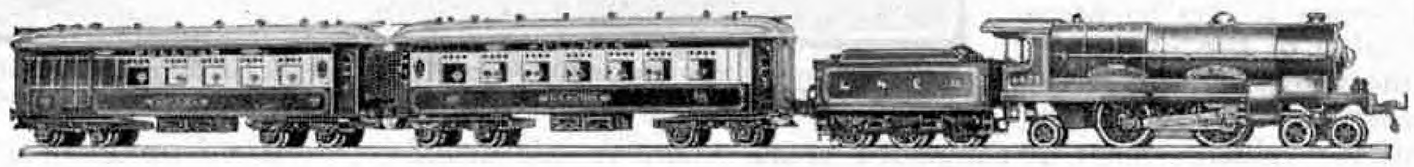
Hornby No. E120 Special Tank Goods Train Set (20 volt, automatic reversing). Price **42/–**



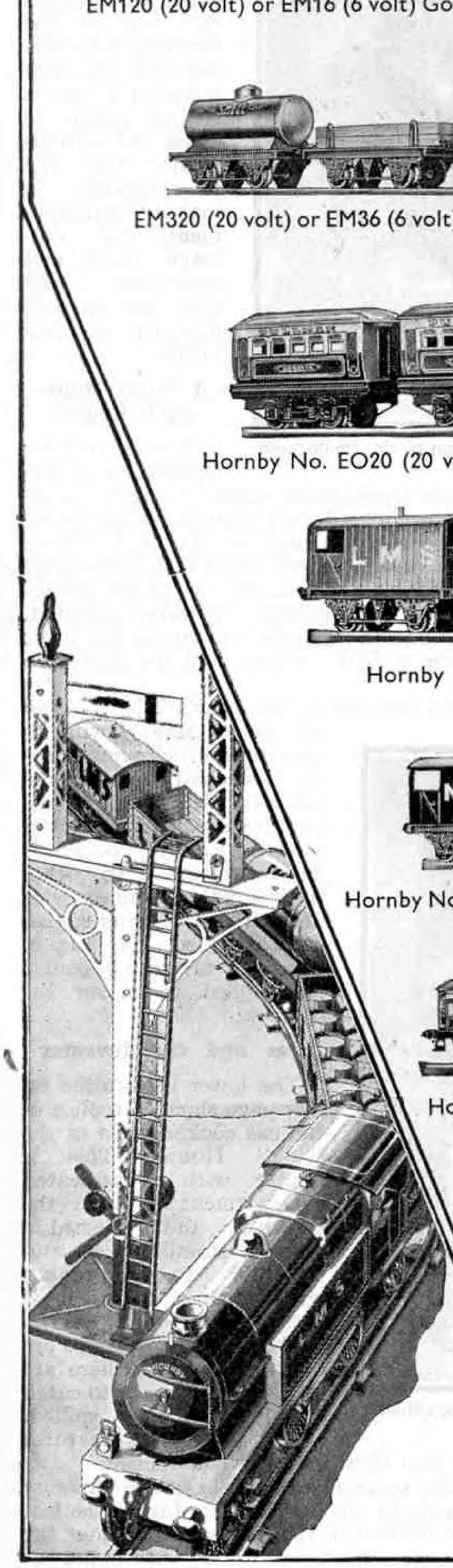
Hornby No. E120 Special Passenger Train Set (20 volt, automatic reversing). Price **47/6**

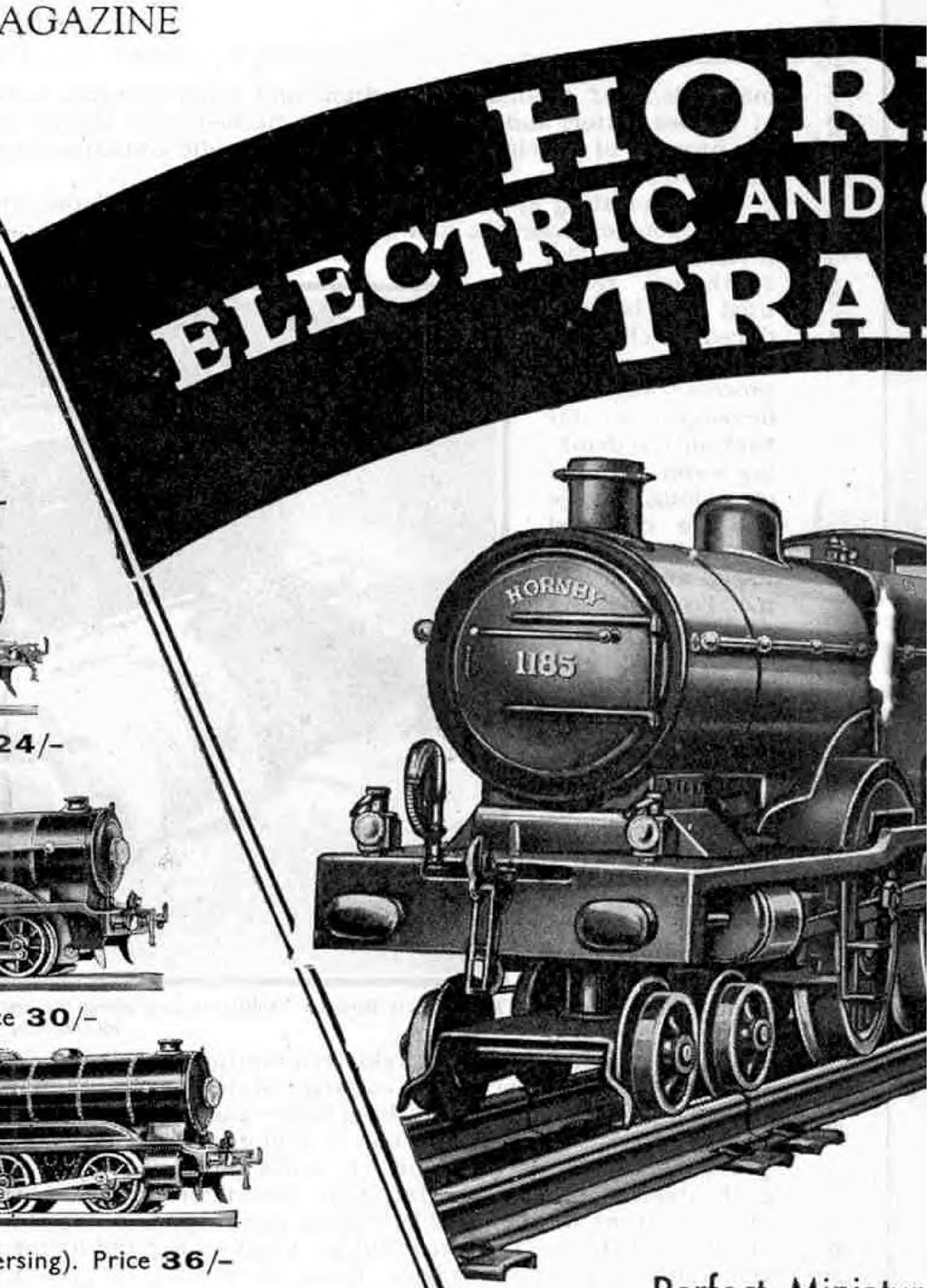


Hornby No. E220 Mixed Goods Train Set (20 volt, automatic reversing). Price **47/6**



Hornby No. E320 Pullman Train Set (20 volt, automatic reversing). Price **72/6**





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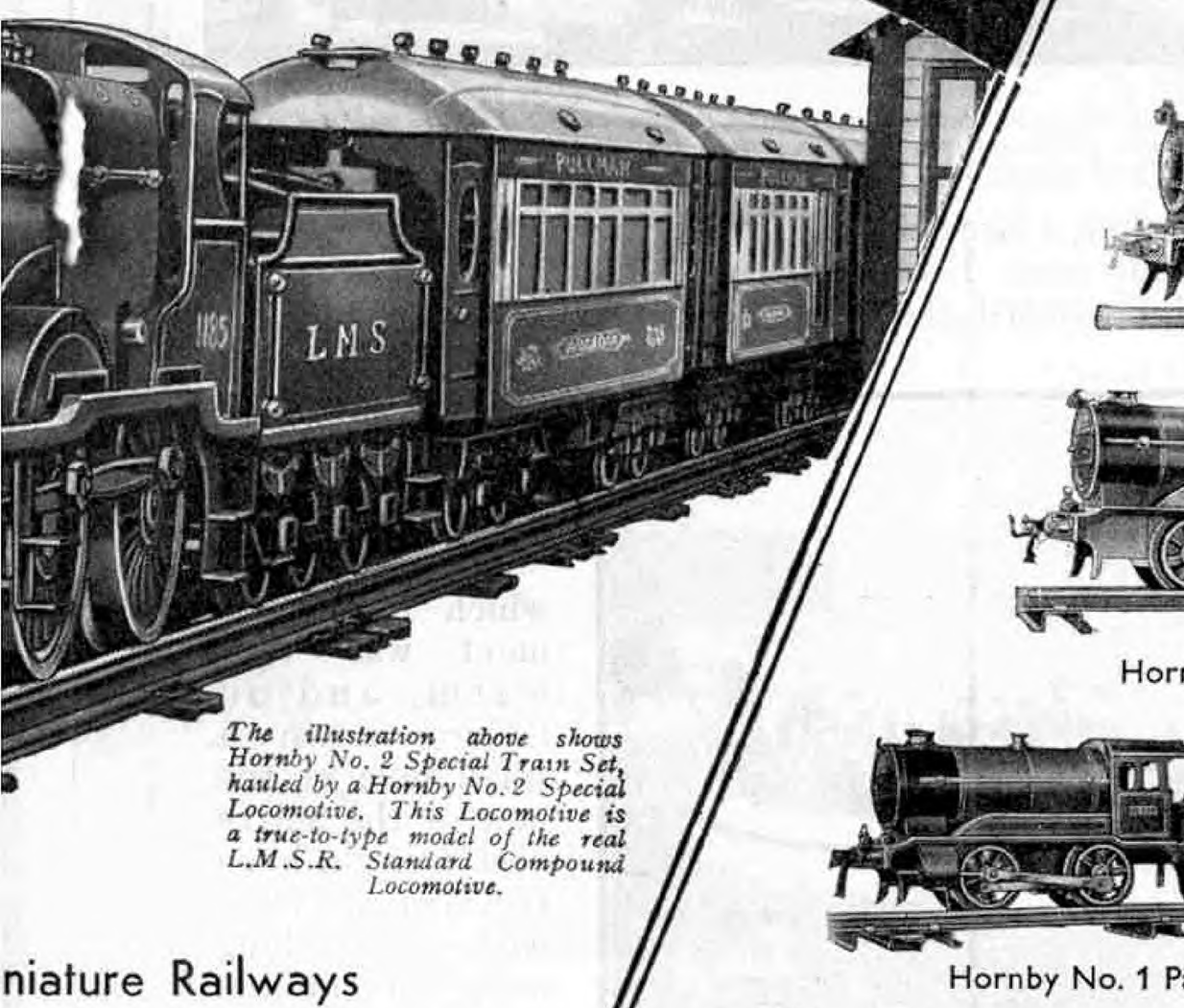
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PRODUCT of MECCAN LIMITED LIVERPOO

Prices of Hornby Electric Train Sets from 15/– to 75/–

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RNBY D CLOCKWORK AINS



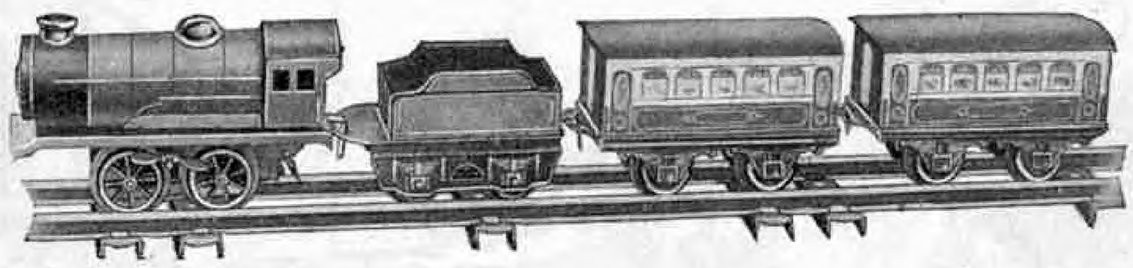
The illustration above shows Hornby No. 2 Special Train Set, hauled by a Hornby No. 2 Special Locomotive. This Locomotive is a true-to-type model of the real L.M.S.R. Standard Compound Locomotive.

niature Railways

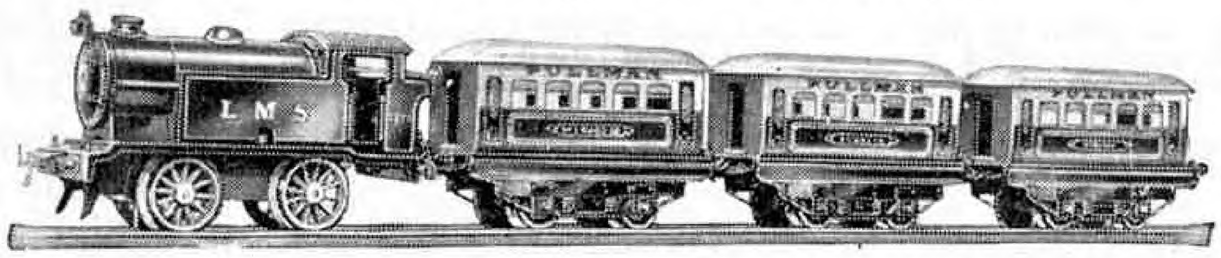
work Trains are such great favourites enable almost every operation in ried out accurately and efficiently. re magnificent. No others run thers pull such heavy loads. ck is smooth-running and is atic couplings. The range e seen on the big railways. ries are realistic, and in rti They provide boy uld wish for to way omplete repre- of the real thing. e realism of your y including some cessories that are or electric light- ll details will be l on page xv.

PRODUCT of MECCANO LIMITED LIVERPOOL

HORNBY CLOCKWORK TRAIN SETS



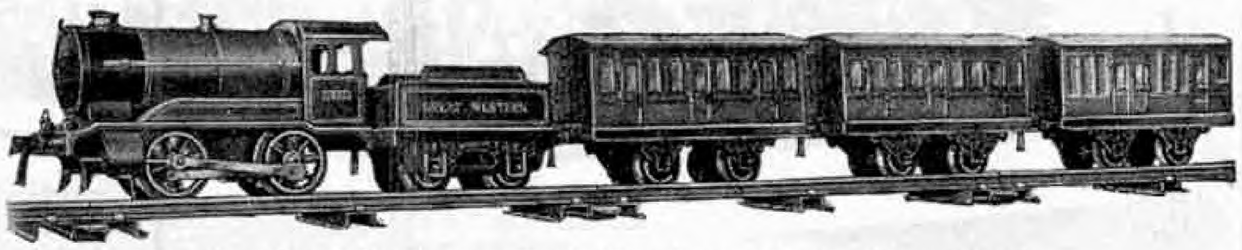
MO Passenger Train Set. Price **5/6**



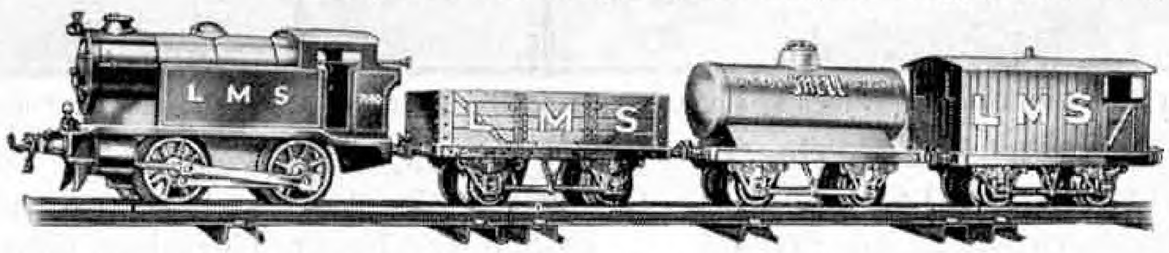
M3 Tank Passenger Train Set (reversing). Price **13/9**



Hornby No. O Goods Train Set (reversing). Price **17/6**



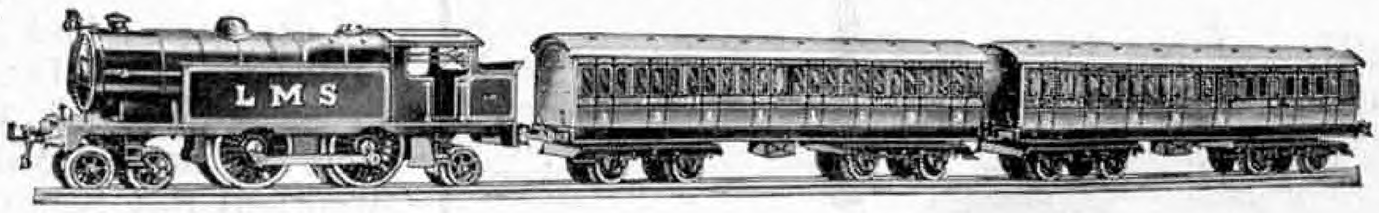
Hornby No. 1 Passenger Train Set (reversing). Price **25/-**



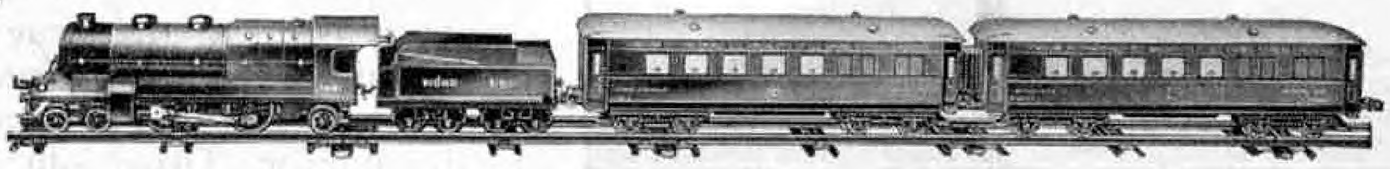
Hornby No. 1 Tank Goods Train Set (reversing). Price **22/6**



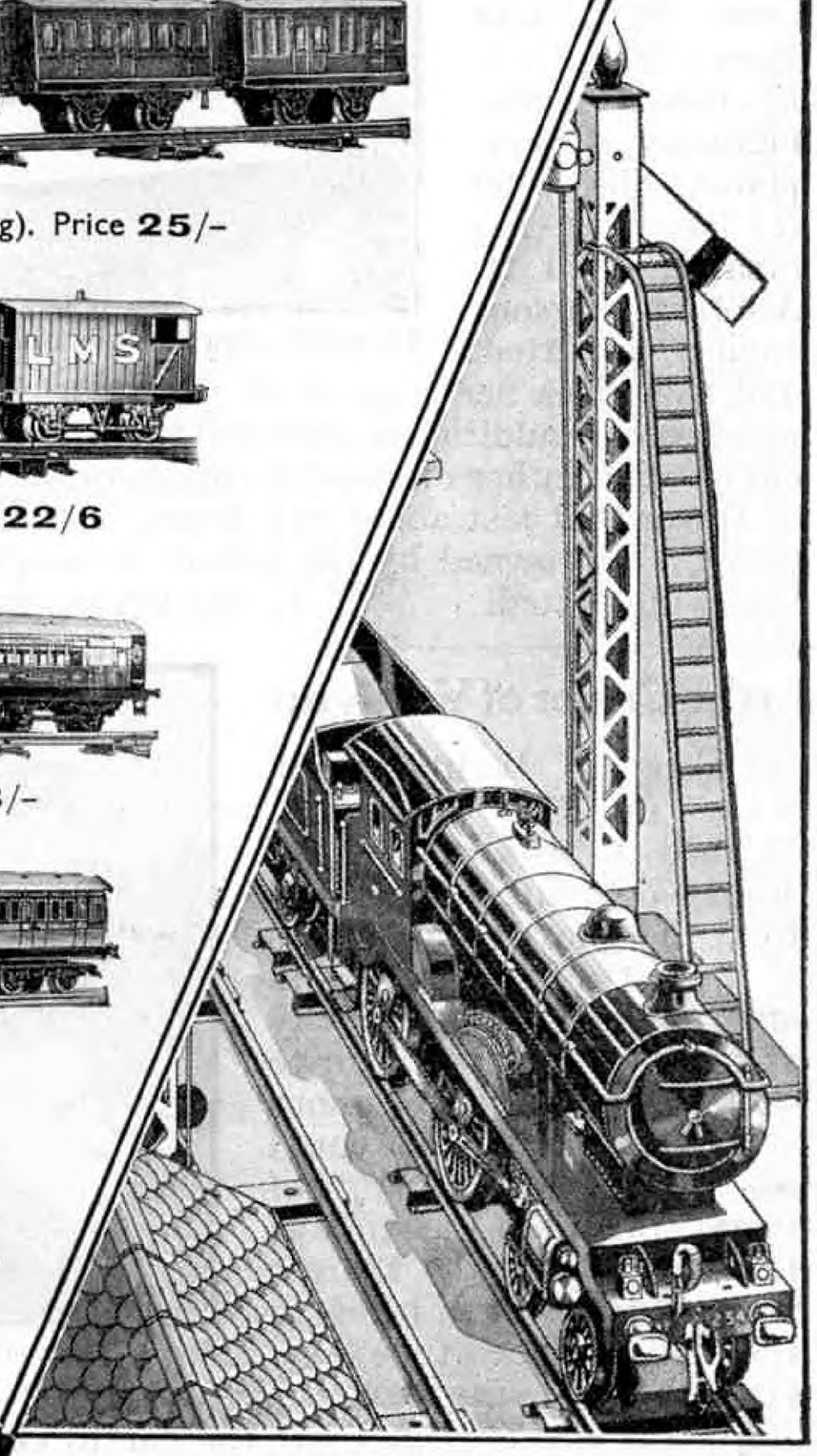
Hornby No. 1 Special Passenger Train Set (reversing). Price **33/-**



Hornby No. 2 Tank Passenger Train Set (reversing). Price **40/-**



Hornby No. 3C Riviera "Blue" Passenger Train Set (reversing). Price **57/6**



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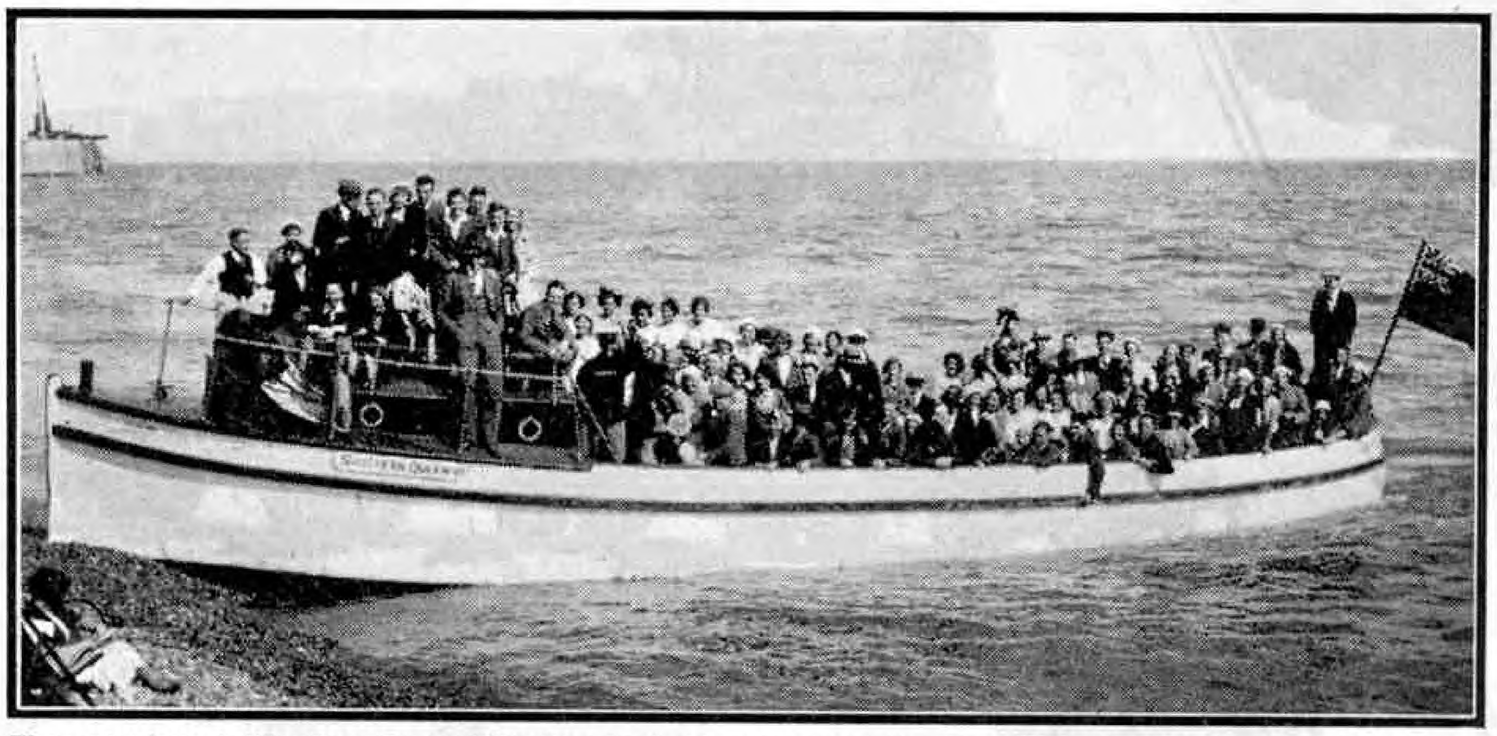


These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Coastal Cruises in a Motor Launch

The upper illustration on this page shows the motor launch *"Southern Queen II."* This is owned by my father, and I help him on his daily cruises during the holiday season at Folkestone.

The *"Southern Queen II"* was built by Short Bros., Rochester, the famous manufacturers of aeroplanes. She is 60 ft. long and her breadth is 11 ft. A 42 h.p. Parsons engine is fitted, and this gives her a speed of 10 m.p.h. She carries 77 passengers in addition to a crew of three, and I thoroughly enjoy being in her on coastal cruises through the Straits of Dover that last about two hours. The first *"Southern Queen,"* also owned by my father, is smaller than the vessel illustrated. F. E. SAUNDERS (Folkestone).



The motor launch "Southern Queen II" with a load of happy passengers. Photograph by F. E. Saunders, Folkestone.

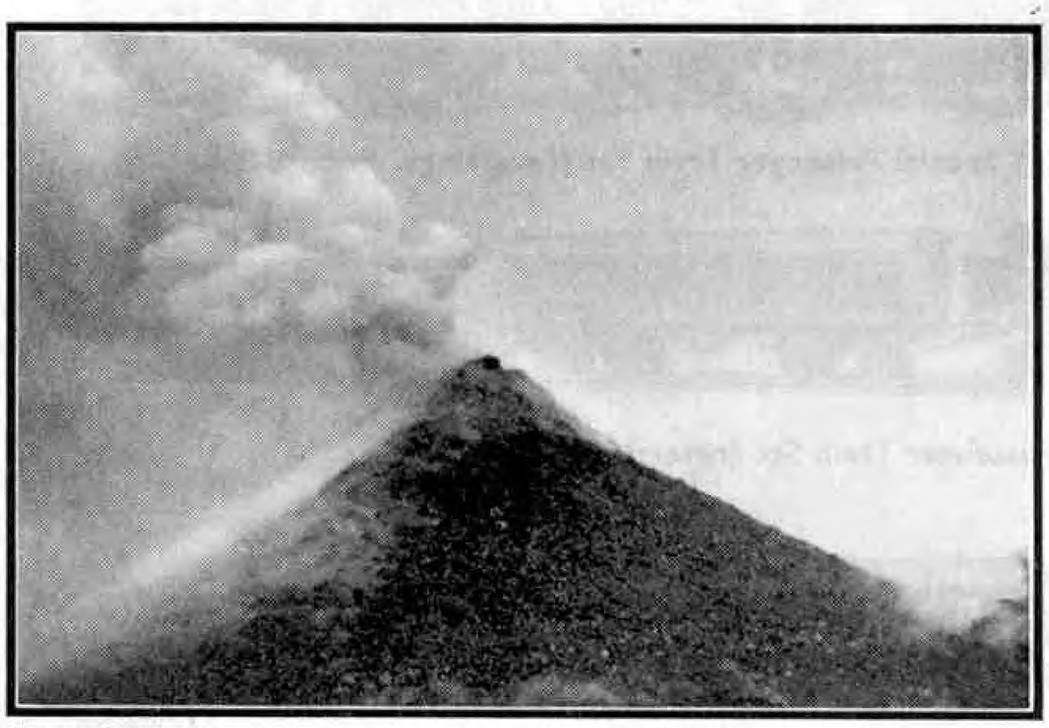
In the Crater of Vesuvius

During a Mediterranean cruise on the *"Doric"* I climbed to the summit of Mount Vesuvius. I was taken from the quayside at Naples in a fast "Fiat" car, and after passing through the city at high speed soon began to climb the slopes of the famous volcano. Far above I could see the smoky pennant of steam trailing in the wind at the summit, and as the car rounded the hairpin bends in the road I noticed that vegetation became scarcer and the air seemed much cooler.

All was silent when I left the car to climb the huge mound of lava, and there were no birds or plants to be seen, only clouds, floating above and below me, and of course the volcano itself. After a sharp walk I reached the crater, a large circular hollow in which was a smoking volcanic cone. I scrambled over the floor of the crater until I reached the foot of the central cone. The lava around me was of various colours, and I saw patches of sulphur here and there.

A crevice into which I put my hand was very warm, and on looking down a small hole at the foot of the active cone I saw a huge red-hot cavern with a seething mass of molten lava at the bottom. I could feel the heat through my shoes, and was rather disturbed once, when the ground shook and steam mounted from the central cone in a fierce burst, to reflect that only two or three feet of solid ground separated me from the inferno below. The guide told me that at times the hole into which I looked is so cool that men can be lowered into it to inspect it.

J. OLIVER (Barking).



The volcanic cone in the crater of Vesuvius. Photograph by J. Oliver, Barking.

A Canadian Summer Camp

Last year I had a splendid holiday at Camp Tamaracouta, in the Laurentian Mountains. This is maintained by the Montreal Boy Scouts Association, and is run on the system of a Hudson's Bay Company trading post. The flag of that company is flown and, true to the detail of a trading post, the head of the camp is known as the Factor. Other officers are the Trader, who looks after the stores; the Artificer, in charge of the tents and hardware; and the Voyageur, who makes all the necessary journeys outside the camp. The sites into which the camp is divided are named after famous Hudson's Bay Company trading posts. N. M. COMPTON (Westmount, Quebec).

Line Fishing in the Firth of Forth

I stayed recently at Pittenween, a typical Fifeshire fishing village, and there had opportunities of seeing how line fishing is carried on. In some cases a line carrying hundreds of baited hooks is suspended between two buoys, but the spreul, or ripper, is employed when cod are plentiful. This is a fish-shaped object, made of bright metal, that carries five or six hooks and is jerked up and down at the end of a long fishing line. When the line is wet the total weight of the spreul is about 7 lb., and jerking it for hours on end is a heavy task. The fish, usually cod, snap at the shining metal, imagining it to be a tasty tit-bit, and are caught on the surrounding hooks.



A 25-lb. cod pulled aboard a Fifeshire fishing boat by our reader, D. Whitfield, Glasgow, during an early morning fishing trip in the Firth of Forth.

On one occasion I spent an early morning out with the fishing fleet. The yawl in which I sailed cruised up and down the Firth of Forth by May Island from 5 o'clock until noon, and we stopped every now and then to work the spreul. The morning was misty, and it was fascinating to see other yawls and one or two large tramp steamers looming up out of the mist and then disappearing once more as they passed on. Fish were scarce, however, and the catch only amounted to one score and ten cod, to employ the fisherman's method of reckoning. The minimum for a profitable trip is three score, and clearly the fisherman's life is not the way to wealth. I had several spells at the line, but no luck came my way. I excelled in gaffing the fish brought to the surface, however, for I had the honour of pulling aboard the biggest fish of the trip. This was a fine 25 lb. cod that later was sold for what seemed to me the poor price of 6/8.

D. WHITFIELD
(Glasgow).

A City of Contrasts

Colombo, the chief port of Ceylon, is a calling place for many liners bound for Indian ports, China and Australia, or coming from them. There East and West mix in an amazing manner. Even in the harbour the contrast can be seen, for mingled with great liners and small cutters are slow-moving native craft with their scantily clad crews. Near the water front are many magnificent modern buildings, all spotlessly clean; but the Eastern side of the picture is revealed by a walk through the native quarters. There the visitor is sure to notice red stains along the footpath, and these are due to the custom followed by many natives of chewing betel-nut.

Transport in the city offers more contrasts, for there are electric tramcars, splendid motor cars and lorries in the main street, and with them bullock carts, similar to that shown in the accompanying illustration, and rickshaws. The rickshaw man is very persistent and patient in his efforts to secure customers, and has no difficulty in recognising tourists. Even those who seek refuge from his persuasions in a café may find him waiting for them when they emerge half an hour later. Smiling blandly, he talks rapidly to them and simply will not be shaken off; and when at last the victims give up the struggle he takes them for a ride that is a novel and interesting experience.

A. R. PRINCE
(Manchester).



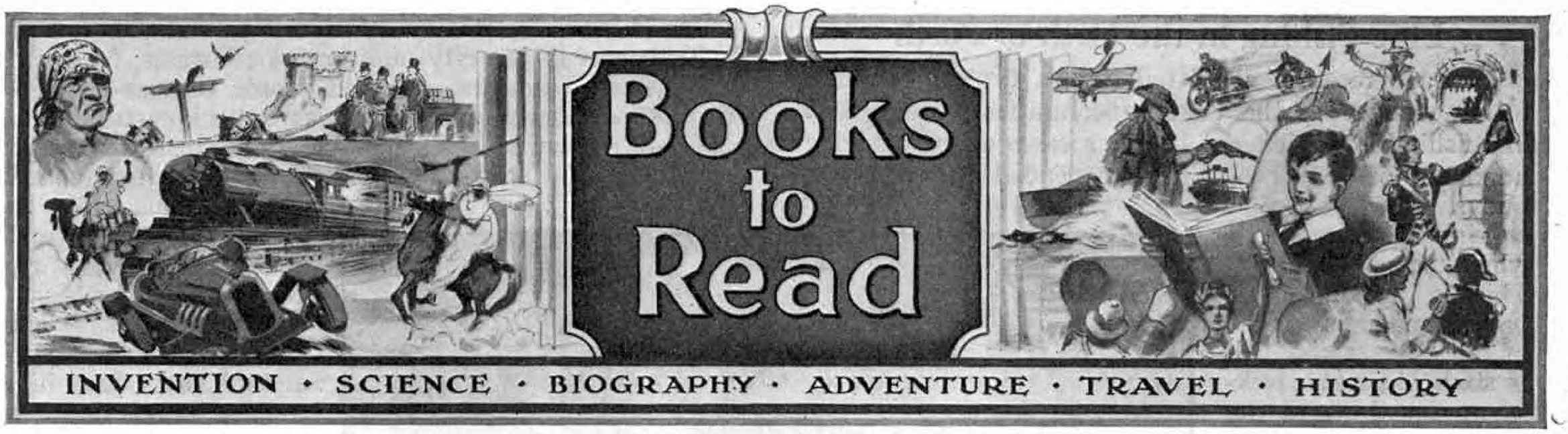
An interesting scene in Colombo. Photograph by A. R. Prince, Manchester.

The Sport of Falconry

Falconry is not now practised as widely as it was in the Middle Ages, when the sport was very popular among all classes. Only an Earl could then carry a peregrine, one of the long-winged falcons. A goshawk was the hawk for a yeoman, and a priest was restricted to a sparrow-hawk, both these birds having shorter wings than the peregrine. The female bird is preferred to the male for hunting purposes because it is larger and stronger.

The sparrow-hawk is flown in wooded country, and at a quarry ranging in size from the sparrow to the pigeon or the partridge; and the peregrine is employed in open country. The necessary training depends entirely on whether the bird is long-winged, or belongs to the short-winged class. Training the sparrow-hawk requires great skill, but the peregrine is more easily dealt with. It is taken from the nest as soon as the down has been nearly replaced by feathers, and is placed in the hawking loft, or "mews," where it remains until it can fly. It is fed once a day, always at the same time, and gradually becomes familiar with the falconer who feeds it. It can then be introduced to the lure, which consists of four ducks' wings placed over a heavy padded article. The hawk is fed daily with meat tied to the lure until it understands that the appearance of the latter heralds a meal and flies to it whenever it is shown. The critical moment comes when the hawk is thrown into the air in the open. The lure is thrown, and the hawk drops down on to it, if the training has been successful.

R. B. LORD (Coventry).



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books vary, but any balance remaining will be refunded.

"My Thirty Years of Speed"

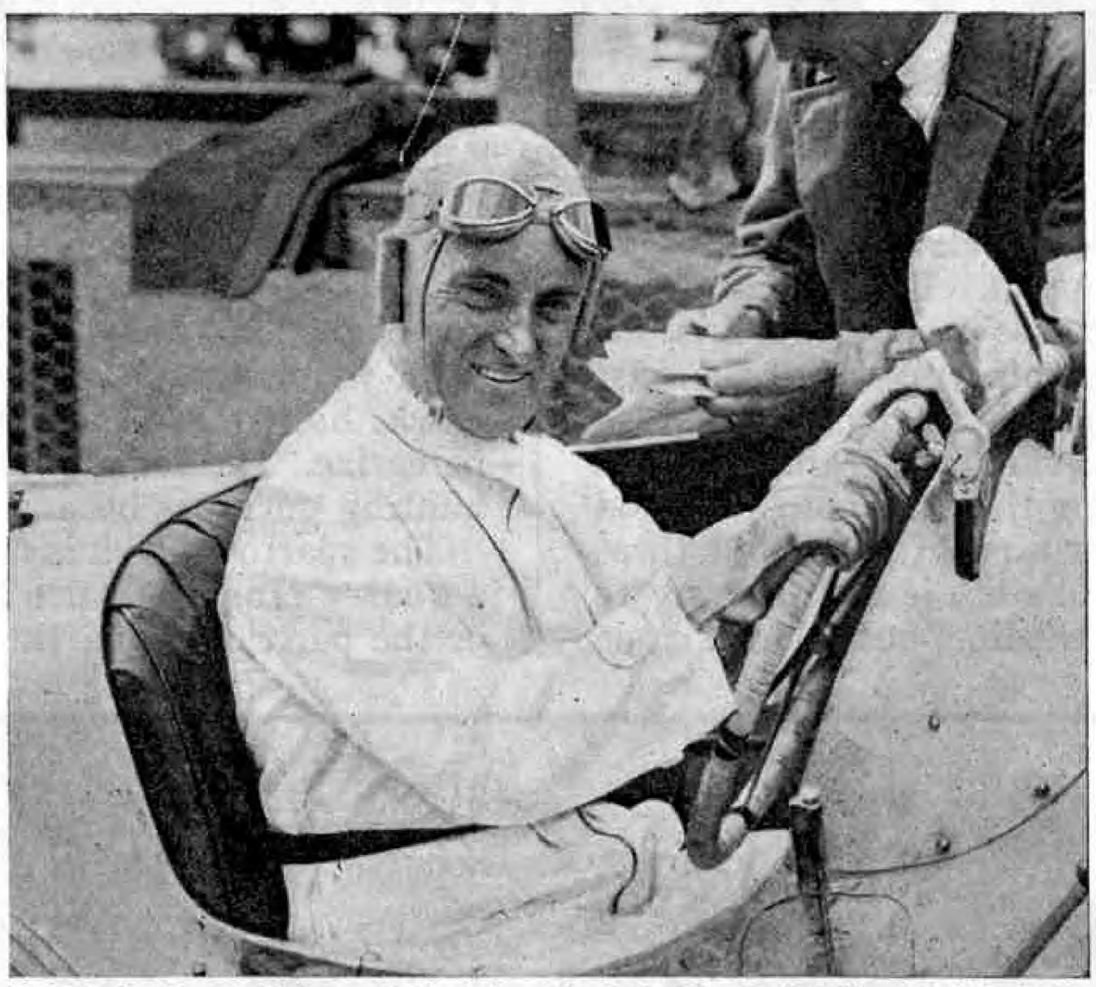
By Sir MALCOLM CAMPBELL. (Hutchinson, 10/6 net)

Sir Malcolm Campbell has held the world's speed record on more occasions than any other racing driver, and has won an immense number of trophies and honours on road and track. In addition he has encountered adventure in the air, while hunting for pirate treasure, and while yachting; and probably has escaped death on land and sea more often than any man alive. The story of the career of such a great sportsman, who has lived dangerously and with immense zest, cannot help being thrilling, and in his book the author has told it modestly, but in a straightforward manner that will satisfy the highest expectations of his readers.

Sir Malcolm revealed his adventurous spirit even as a boy, and when only 15 years old rode in cycle races against professionals in a small German town where he was studying engineering. As he grew older he graduated through motor cycles to motor cars, and then the famous flight across the English Channel by Bleriot in 1909 led him to build an aeroplane, designed with the aid of the scanty information available in those pioneer days. Lack of experience led to several crashes, and his experiments came to an end for want of money before he had accomplished more than a few hops.

The unfortunate end of his efforts to fly led Sir Malcolm to turn his attention to motor racing, in which he has achieved his greatest triumphs, and which he pursued continuously except for a period during the War, when he served with distinction in the Royal Flying Corps. He failed to finish in his first important long-distance event, the 200-mile race of the Junior Car Club at Brooklands in 1923, but afterwards he won second place in the English Grand Prix of 1926, and was the winner of the 200-mile race in 1927. He also took part in road events on the Continent, and he gives exciting and well-written descriptions of these events.

The greatest thrills come with his stories of his repeated attempts on the speed record. There is much more in creating a world's land speed record than the danger and difficulty of driving a car at terrific speed over a measured distance. Every detail in the design and construction of a suitable car must be studied carefully, and success depends on perfect tuning. A straight course also is required, on which there is room to work up to speeds approaching 300 m.p.h., and to slow down again. Even in the search for such a course Sir Malcolm met with adventure. On one occasion he flew to Africa in the hope of finding a good track in the Sahara Desert, and on his return was forced down among armed Riff tribesmen, then at war with Spain. He escaped only after an adventurous journey through territory in which there had recently been heavy fighting.



Sir Malcolm Campbell, immediately before the start of the British Grand Prix in 1926. (From "My Thirty Years of Speed," reviewed on this page.)

During the author's career he has driven his famous "*Blue Bird*" on sands in Great Britain and Denmark, on the bed of a dried-up lake in South Africa, and on the beach at Daytona, Florida. It was on the famous American natural speedway that he made his most thrilling runs, and the story of the successive efforts that have raised the record to the present figure of 276.816 m.p.h. ends with the author's declaration that even yet he is not satisfied, although he has passed the age at which even the most hardened racing motorists seek adventure. "I know that 300 m.p.h. is possible," he writes, "and I know that '*Blue Bird*' can do the speed. When opportunity offers, I shall try again."

The book is well illustrated by a large number of photographs showing the author at speed in his famous cars, or illustrating exciting incidents in his career.

"The Book of Canoeing"

By A. R. ELLIS. (Brown, Son & Ferguson Ltd. 3/6 net)

Canoeing in the British Isles seems to be experiencing the beginning of a wave of popularity, largely as the result of the introduction of a really practicable folding boat with which transport difficulties are reduced to the minimum. The author combines enthusiasm and experience in the right proportions, and his book will be of the greatest possible value for anyone who contemplates the use of a canoe. First of all he gives general hints on dealing with the various problems to be encountered on river and canal, and then he passes on to canoeing in all the more accessible parts of England, Scotland and Ireland. Not content with this, he has something to say on the greater thrills of sea canoeing which, he emphasises, should not be undertaken until considerable experience has been gained on inland waters. The book, which is illustrated by photographs and diagrams, is interestingly written, and reveals in a most attractive manner the canoeing possibilities of the British Isles.

"Everyday Botany"

By L. J. F. BRIMBLE, B.Sc.
(Macmillan. 7/6)

This book covers every aspect of plant life, but is far from being a dry scientific work. The aim of the author has been to show how and why plants are useful to us. Throughout he emphasises the applications of plant products, whether as foodstuffs or as commercial commodities, with the result that the book is of special value to students of medicine and pharmacy, and to those who are taking up careers in forestry, horticulture or agriculture. At the same time it is attractive to the general reader who wishes to know something of this interesting branch of science and its relation to our everyday life. There are 340 illustrations, consisting chiefly of reproductions of photographs of growing plants.

"1001 Wonderful Things"

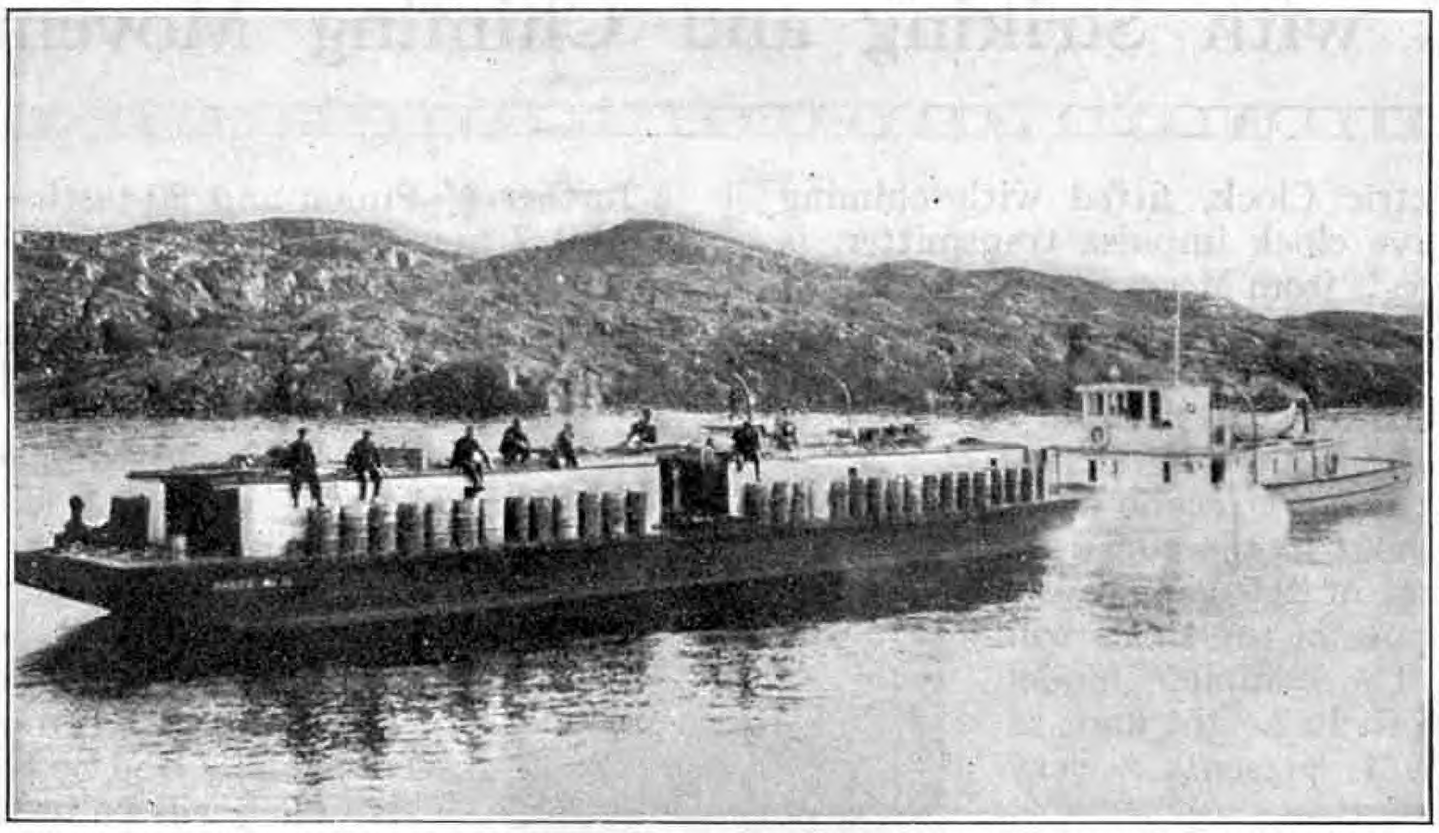
(Hutchinson. 3/6 net)

This is an astonishing collection of photographs of almost everything under the Sun. In more than 500 pages of pictures it deals with the wonders of animal life, antiquity and architecture, engineering and invention, the Earth and the heavens, paintings and sculptures, and the creatures of prehistoric times. It would indeed be difficult to find a subject that is not represented in the collection. Each illustration is accompanied by a brief description, and the book forms an excellent addition to any library.

"Sands, Clays and Minerals"

Edited by A. L. Curtis. (Volume II, No. 3. 3/6)

This quarterly magazine is intended for those who are interested in the production and use of economic minerals of all kinds, but many of the articles are of great general interest. The present issue contains a particularly valuable contribution of this kind by Dr. H. S. Spence, of the Department of Mines, Ottawa, Canada, who gives an authoritative account of the discovery that has given Canada a prominent position among the countries producing radium. This metal is now obtained from rich ore mined on the shore of Great Bear Lake, in the far north of Canada and almost on the Arctic Circle. Except for three months in the summer, when the ice on the Lake and the rivers leading from it melts, the site can only be approached easily by air.



A barge loaded with supplies and equipment arriving at the radium mines on the shores of Great Bear Lake in northern Canada. (From "Sands, Clays and Minerals," Vol. II, No. 3, reviewed on this page.)

To-day the scene of the discovery is one of great activity, although four years ago it was practically unknown. Crushing mills have been established to concentrate the ore, and when navigation is open stores and equipment are rushed there, and ore is brought out for treatment at refineries in Ontario, 4,000 miles away, in barges and scows of the kind shown in the upper illustration on this page. A regular air service is maintained practically throughout the year by machines fitted in summer with pontoons and in winter with skis, and there is even talk of the construction of a railway.

The remaining articles in this issue well maintain the high standard already achieved by this journal. Among them is a contribution dealing with the mineral resources of Tasmania, in which the difficulties encountered by prospectors are graphically described. Other articles deal with early lead mining in Great Britain, and tin mining in Cornwall, an industry that began at least 3,000 years ago. The latter contribution is made more attractive by the inclusion of interesting drawings of old stamping mills and water wheels, Newcomen steam engines, and the famous "man engine" by which the miners gained access to the workings.

"Handicraft Woodwork"

By A. L. Keble. (Pitman. 7/6 net)

The high standard of the Pitman books on arts and crafts is fully maintained by this interesting volume. It has been produced chiefly as a practical handbook for teachers and students of handicraft woodwork, but it will be found of real value to all who are interested in artistic woodwork. The instructions are extremely simple and never dull, and they range from technical drawing to the practical use of tools, and suggestions for the making of a great variety of interesting articles. The illustrations are remarkable both in number and quality.

"Broncho Charlie"

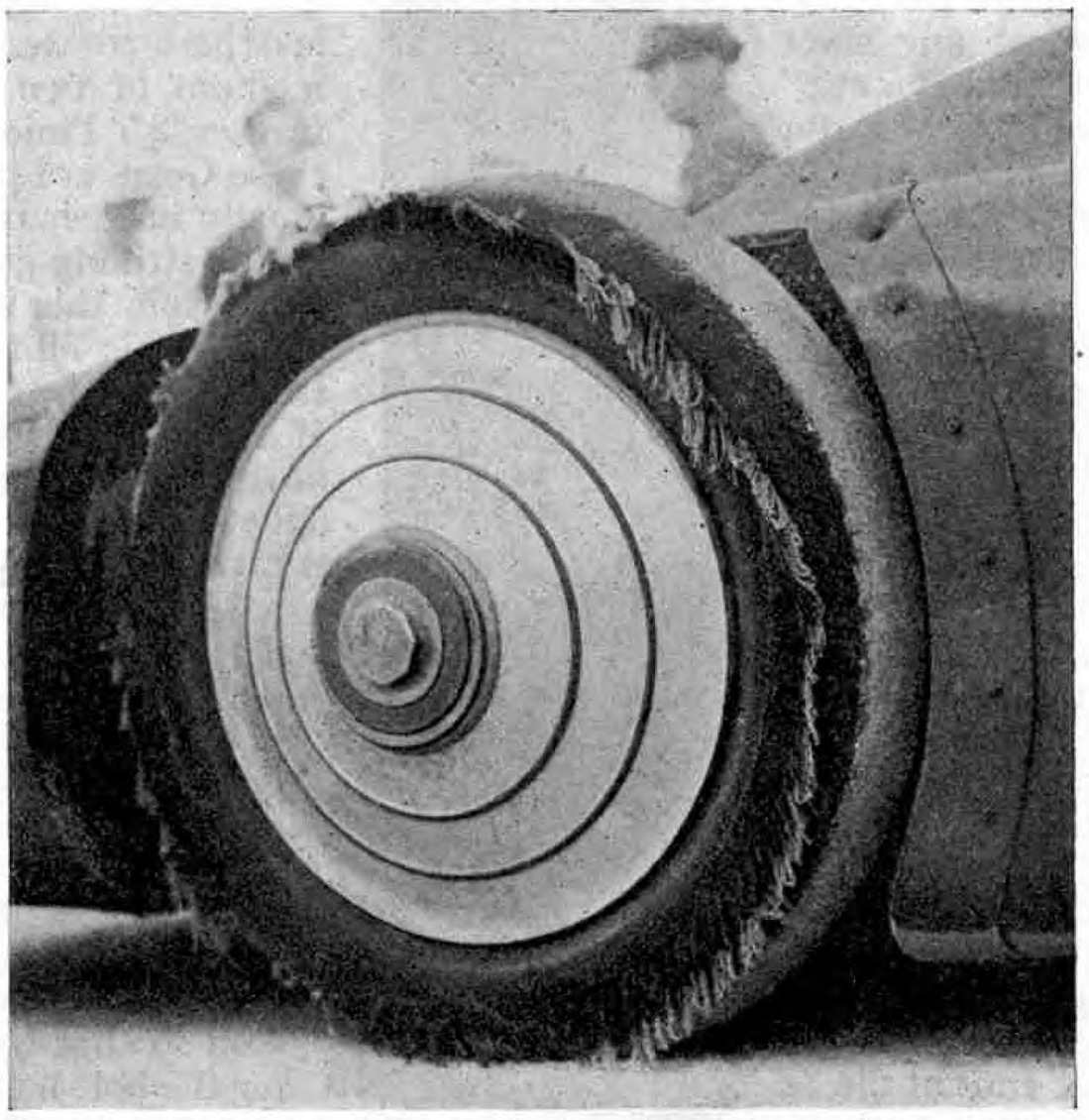
(Harrap. 8/6 net)

Broncho Charlie is the last of the famous Pony Express riders, and one of the few remaining living links with the picturesque days of the old "Wild West." His career has been crowded with thrills and excitement, and in this book his story is revealed in his own words, as recorded by Miss Gladys Shaw Erskine.

Broncho Charlie was born in a covered wagon in 1850, during the gold rush to California, and was familiar from childhood with Indians and cowboys. He claims to have broken in his first horse at the early age of eight, and the breaking in of wild horses on the great ranches of the West remained his principal occupation. At the age of 11 he took the place at a moment's notice of a missing Pony Express rider, who had probably been shot by Indians, and carried out his task so well that he was enrolled as a regular rider. He was provided with the little leather-bound Bible and the six-shooter that formed part of the equipment of those who risked their lives carrying the mail over prairie and mountains infested by Indians.

When the Pony Express Service ended, Broncho Charlie drifted about the West, "broncho-busting" and taking part in a variety of fights; and on one occasion he was tricked into a brief spell of "cattle rustling." He became the friend of famous Indian chiefs, and acted as a scout in desperate Indian warfare. At length he met Buffalo Bill, and joined his Wild West Show, with which he visited England. During the Great War he succeeded in enlisting in the Canadian forces, although he was then nearly 68 years of age!

The story is full of the thrill and excitement of pioneer days, and is all the better for being told in the rough but expressive language of the old-timer himself. In view of his claims to have achieved a reputation as a famous "broncho-buster," and to have met so many important men, it seems a little strange that his own name has not become as well known as that of other pioneers, but thoughts of this kind will not disturb the pleasure of reading such a stirring and romantic book.



One of the tyres of Sir Malcolm Campbell's "Blue Bird" at the end of the run in which the world's land speed record of 276.816 m.p.h. was made. (See opposite page.)

"Some Birds of the London Zoo"

By F. Martin Duncan, F.Z.S.
(Bale, Sons & Danielsson Ltd. 6/- net)

Of the making of Zoo books there seems to be no end, but all are welcome so long as they reveal something of the spirit of the creatures. Mr. Martin Duncan, who is librarian to the Zoological Society, tells us that in this book he set out to give a non-technical account of the habits and life history of some of the Zoo birds with which he is on terms of friendship. He has succeeded well in this attempt, and his chatty descriptions of the birds selected convey a great deal of information in the most attractive way. The descriptions are accompanied by a series of 26 excellent coloured plates from the author's original water-colour drawings. This is a book that will interest all bird lovers, and is just the thing to read before and after a visit to the Zoo.

"Brush Up Your Children's French"

By Dr. W. G. Hartog, M.A. (Dent, 2/6)

This is a reprint in book form of the adventures of two children, Yvonne and Pierre Dupont, that have already delighted young readers of the *"Daily Mail."* The adventures are related in 50 short episodes, which are given in both French and English. Boys and girls who are now studying or wish to study the French language will find the book fascinating, amusing and thoroughly helpful. It is illustrated with many delightful line drawings.

A Meccano Master Clock

Fitted with Striking and Chiming Movements

THIS Meccano Electric Clock, fitted with chiming mechanism and slave clock impulse transmitter, is the result of many requests from Meccano model-builders for details of striking movements and master clocks. As far as possible the various movements of the model have been operated electrically, the necessary current being derived from a T20A Transformer concealed in the base. Meccano parts have been used throughout in the construction, with the exception of the gong tubes and "snails." The purpose of the snails will be made clear later. The complete model stands slightly under 5 ft. in height and, as will be seen from Fig. 1, presents a very modern appearance.

Although at first glance the model would appear beyond the scope of the average boy, it is comparatively easy to construct if the various sections are built and erected in the manner described in this article. The time-keeping qualities of the model are excellent, and the Westminster chime with which it is fitted adds considerably to its interest.

As a master clock it is very reliable, and transmits time signals at half minute intervals. It is suitable for use with almost any slave clock, and also with the model "Pul-syn-etic" Electric Clock described in the *"M.M."* for April last. Any number of slave clocks can be operated from this master clock.

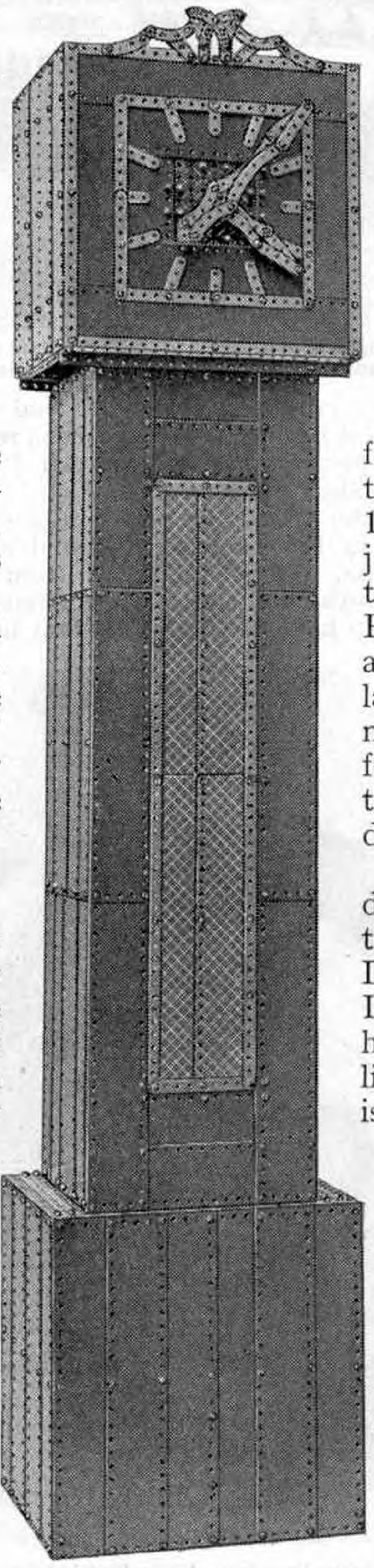


Fig. 1. A clock case of modern design for carrying the mechanism described in this article.

Building the Mechanism

The framework and three separate gear trains are shown in Fig. 2, one corner Angle Girder of the frame having been removed to show the construction more clearly. Two $9\frac{1}{2}''$ Angle Girders form the base, and these carry at each corner a vertical $12\frac{1}{2}''$ Angle Girder, two further $12\frac{1}{2}''$ Angle Girders 1 being fitted at the top as shown. The two E120 Electric Motors 3 and 4 must be fitted at this point, as these hold the back and front of the mechanism frame together. The front is built in with six $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates as shown in Fig. 3, the two upper corners being left open. The back of the frame is fitted with a long vertical plate built up from three $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates. These support the inner ends of five $3\frac{1}{2}''$ Strips, two of which are arranged on one side of the Plates and three on the other. The outer ends of the Strips are bolted to the two rear $12\frac{1}{2}''$ Angle Girders.

The fitting of the gears is commenced by incorporating the reduction train between the pendulum and hands. A Ratchet Wheel 2, spaced away from the Plate by a Collar, is mounted on a $3\frac{1}{2}''$ Rod that carries a $\frac{1}{2}''$ Pinion. This Pinion engages with a 57-teeth Gear mounted on the same Rod as a $\frac{3}{4}''$ Pinion 5 that rotates a 50-teeth Gear 6. This Gear in turn is connected, via a further $\frac{3}{4}''$ Pinion and 50-teeth Gear, to the $2\frac{1}{2}''$ Gear Wheel 7 mounted freely on the $6\frac{1}{2}''$ Rod 8, Fig. 2. A Collar on this Rod prevents the boss of the Gear from bearing against the Plates forming the front of the mechanism case. The rear face of the Gear is kept in close contact with a 1" Dunlop Tyre by means of a $1\frac{1}{2}''$ Pulley 9, the Tyre being mounted on a 1" loose Pulley. The $1\frac{1}{2}''$ Pulley is pressed against the Tyre and locked on the shaft by its set screw. The clutch so formed enables the hands of the clock to be turned without disturbing the mechanism.

The Collar 10 can now be fitted, being secured on its Rod by two 7/32" Grub Screws. This Collar will be incorporated later in the slave clock transmitting mechanism.

The gear train through which the Motor 4 drives the chiming drum is built up in the following manner. An E120 Motor Pinion on the armature shaft meshes with a 57-teeth Gear 11, the Rod on which this is mounted being journalled in the Motor side plates. Between these two side plates the Rod carries a $\frac{1}{2}''$ Pinion that drives a 57-teeth Gear, mounted on a 3" Rod 12, together with a $\frac{1}{2}''$ Pinion. This last part rotates the $6\frac{1}{2}''$ Rod 13 through the medium of two $2\frac{1}{2}''$ Gears 31 and 32 and a further $\frac{1}{2}''$ Pinion. All the Rods supporting these Gears are prevented from sliding longitudinally in their bearings by means of Collars.

The striking gear train is now built up. The drive from this is taken from the armature of the Electric Motor 3, by a special Pinion and Driving Band, to a 2" Pulley Wheel 14, Fig. 4. If a Meccano Driving Band is found to be too heavy for this drive it may be replaced by a light rubber band of suitable size. The 2" Pulley is carried on a $3\frac{1}{2}''$ Rod 15 on which is gripped a $\frac{1}{2}''$ Pinion engaging with a $2\frac{1}{2}''$ Gear 16. The $3\frac{1}{2}''$ Rod supporting this Gear carries at one end a Collar 17 secured in place by means of a 7/32" Grub Screw. This Collar and Grub Screw form a cam for operating the electric striking movement as will be described later.

The Rod 8, already mentioned, carries a Bush Wheel 22, and this part carries four equally spaced nuts and bolts as shown in Fig. 4. The Bush Wheel is clamped on its Rod so that there is just sufficient clearance for the bolt holding the Bracket 23. The four nuts are arranged in an exactly similar manner to each other, and they lift, four times every hour, a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket bolted to the end of the lever 24, represented by a $5\frac{1}{2}''$ Strip. A Crank, bolted to the top of the lever 24, is secured on a $3\frac{1}{2}''$ Rod together with a second Crank 25. The Rod carrying these two Cranks is held in place by a Collar 26 and it must swing very freely in its bearings.

A $\frac{3}{4}''$ Bolt 27, carrying a Washer under its head, is

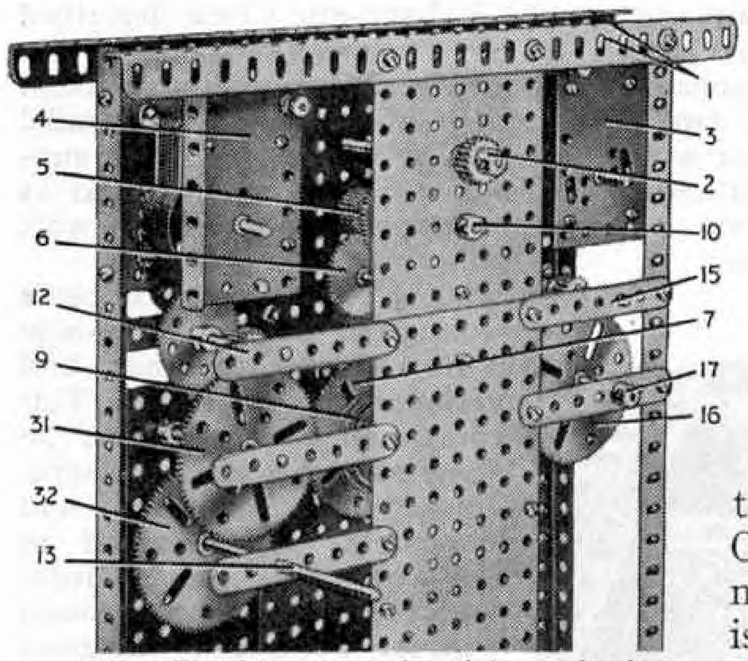
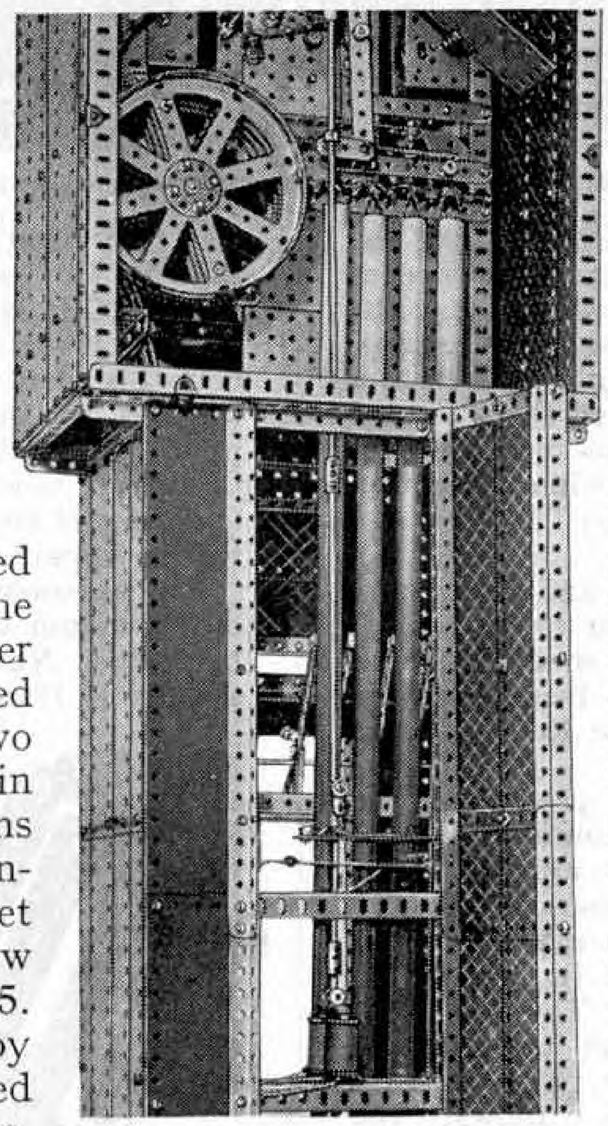


Fig. 2. The three gear trains of the mechanism.

locked in the end slotted hole of the Crank 25 by means of a nut, and this Bolt is normally resting so that it almost touches the head of a second $\frac{3}{4}$" Bolt 28, locked in one of the tapped holes of a Crank boss by a nut. A $2\frac{1}{2}$" Strip 29 is bolted to this third Crank and the free end of the Strip carries a Pawl without boss. The angles and positions of the Strip 29 and Pawl must be carefully copied from Fig. 4. It is best to leave all the electrical connections until the mechanical units are in proper working order.

The gathering pallet 33 is attached to one end of the Rod carrying the $2\frac{1}{2}$" Gear 31, and it is composed of a Coupling in the centre plain hole of which is fitted a Centre Fork. This gathering pallet raises the chiming rack tooth by tooth.

The chiming rack with its attendant mechanism is shown in Fig. 6, this photograph having been taken from the rear of the rack. A $3\frac{1}{2}$" Strip 35 is mounted $1\frac{1}{2}$ in. from one end on a Rod 36 that is mounted freely in the mechanism framework. The Strip is now attached at the end of its shorter arm to a Crank 34 by means of a locknutted bolt (see Standard Mechanism No. 1A). Two $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets are fitted as shown in the illustration, the inner one of which forms a support for an insulated Silver Tipped Contact Screw 37. The remaining Angle Bracket carries a second Silver Tipped Contact Screw 38 that is in metallic contact with the Strip 35. The Crank 34 is now locked on the Rod 36 by its grub screw so that the Strip 35 is allowed to move slightly owing to the play in its holes. This movement need only be sufficient to allow the Contact Screws 38 and 39 to be parted for a distance of about 1/32 in.


Fig. 3. A rear view of the model showing the gong tubes.

A 3" Strip 40 is now passed on to the Rod 36, together with a second Crank 41, locked in place by two grub screws. This Crank and the Strip 40 are braced together by a 2" Strip, a Washer being placed between this and the Strip 40. An insulated $\frac{1}{2}" \times \frac{1}{2}"$ Angle Bracket is now attached to the unit, and this carries a Silver Tipped Contact Screw 39 that is held in contact with the Contact Screw 38 by a short length of Spring Cord. The relative positions of the Strips 35 and 40 should be so adjusted that they may be pulled apart slightly without disturbing the Crank 34.

The outer end of the Strip 40 carries a $\frac{1}{2}" \times \frac{1}{2}"$ Angle Bracket to which a $2\frac{1}{2}"$ Strip is bolted at its centre hole. This Strip, which is fitted with five $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets, must be so curved that it forms an exact segment of a circle with the Rod 36 as its centre. Care must be taken also to see that the five Angle Brackets are equidistant between their tips.

The rack unit is now ready for fitting to the model, and this is done by passing the Rod 35 through one of the holes in the lower centre $5\frac{1}{2}" \times 3\frac{1}{2}"$ Flat Plate of the front of the frame. It passes also through an appropriate hole in one of the Plates at the rear of the frame. The exact position of the Rod is shown in Fig. 4. The $1" \times \frac{1}{2}"$ Angle Bracket 23 is next secured in place by means of a $\frac{3}{8}"$ Bolt. A Washer is placed between the head of this Bolt and the Bracket, and three Washers between the clock frame and the Bracket. An insulated Silver Tipped Contact Screw is supported by the Bracket and this makes contact with the Contact Screw 37, Fig. 6, when the rack is in its top position. Final adjustment of this will be made later.

The chiming snail 42 must now be cut from a thin sheet of brass or tin-plate, brass being preferable because of its non-rusting qualities. In the centre of a sheet of metal $2\frac{1}{2}"$ in diameter and of about .020" gauge, an 11/32" hole is drilled. This must be done very accurately in order to ensure the chiming mechanism working correctly.

Divide the circle into quarters, and cut away a segment of metal from each quarter so that the four sections form a series of steps. Each step must be exactly $\frac{1}{6}"$ lower than the preceding section. The finished snail is shown in Fig. 4 and, as will be seen, it is secured to a Bush Wheel locked on the minute hand spindle of the clock. When the chiming rack is released its movement is limited by the Threaded Pin 43, which bears against the edge of the snail 42.

The operation of the chiming movement is as follows. As the hour approaches, one of the nuts in the Bush Wheel 22 raises the Angle Bracket secured to the lower end of the Strip 24. This motion causes the Crank 25 and short Strip 29 to lift the Pawl out of engagement with the rack. At the same time two Silver Tipped Contact Screws, carried on the Brackets 44 and 45, are drawn apart. The connections for these will be dealt with later.

In falling, the chiming rack opens the contacts 23 and 37 and closes the contacts 38 and 39. This movement is known as the "warning." As the minute hand comes on to the hour mark, the Bracket, carried on the Strip 24, is released from the nut on the Bush Wheel 22, thereby closing the contacts 44 and 45. The motor now starts, and the gathering pallet 33 commences to rotate in a clockwise direction. For every complete revolution it picks up one tooth of the chiming rack, and the Pawl holds the rack as each tooth is picked up. When the last tooth is reached and the gathering pallet is almost slipping clear, the two contacts 23 and 37 come

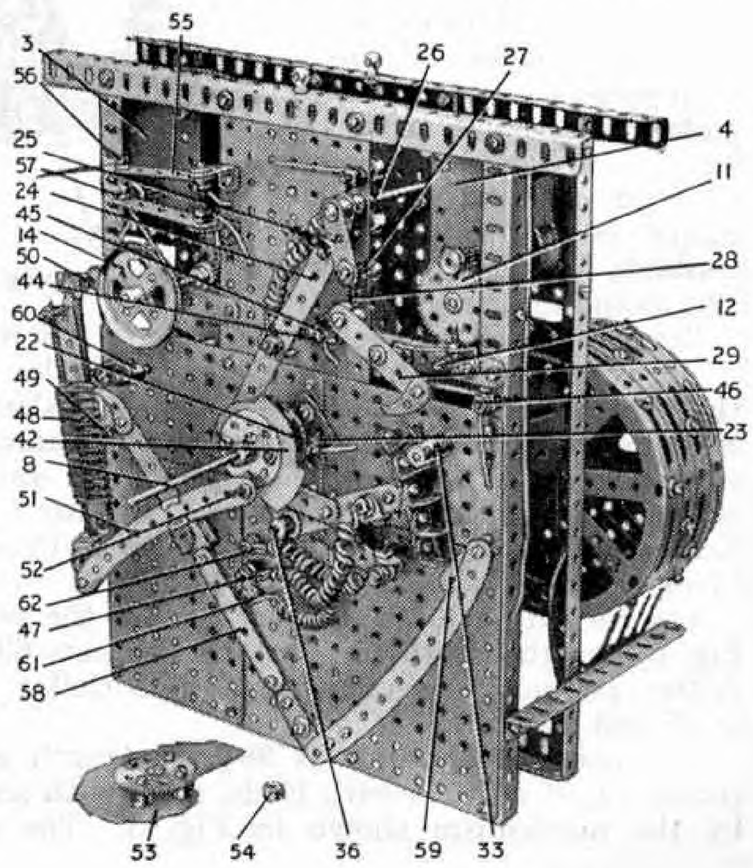


Fig. 4. The complete striking and chiming mechanism.

together, and the resulting movement of the Strip 35 causes the contacts 38 and 39 to open for a fraction of an inch. The motor now gradually stops, thus giving the gathering pallet time to slip clear of the chiming rack.

A similar motion takes place at 15-minute intervals, but the fall of the rack is controlled by the position of the snail 42. At the quarter hour the Threaded Pin 43 comes into contact with the snail at its greatest diameter, and at the half hour at the first step towards the centre. This continues past the three quarters, until at the hour the innermost section is reached.

The electrical connections for the chimes are made in the following way. A wire from the terminal 46 is taken to the contact 45 and from 44 to the terminal 47. A coiled length of wire connects this latter terminal to the contact 39. A further length of wire is used to connect the insulated terminal of the motor 4 to the contact 38 by way of the terminal 62.

The striking mechanism is now fitted. The main portion of this is the vertical rack 48 shown in Fig. 4. Two Eye Pieces 49 and 50 are attached to the frame by Threaded Pins, the Pin carrying the Eye Piece 50 being carried on a Flat Bracket. This form of construction allows for adjustment of the angle of the rack. The construction of the rack will be seen from the two illustrations. It will be seen also that at its lower end it is pivotally secured to a $5\frac{1}{2}''$ Curved Strip 51, which is free to slide in an Eye Piece carried on a $3\frac{1}{2}''$ Rod free to turn in its bearings. The unoccupied end of the Curved Strip carries a $\frac{3}{8}''$ Bolt 52, and this works in conjunction with the striking snail 53 in a similar manner to the Threaded Pin 43 and snail 42.

The striking snail has a maximum radius of $2''$, and this passes down through 12 successive steps to a minimum radius of $\frac{1}{2}''$. Each step is therefore $\frac{1}{8}''$ in depth. The complete snail is secured to a 57-teeth Gear by four $\frac{3}{8}''$ Bolts, four Collars being used for spacing purposes. This snail is free to turn on the Rod 8, but is prevented from sliding forward by a Collar 54.

At the top of its movement the striking rack presses on the underside of a $4\frac{1}{2}''$ Strip 55, thus opening two contacts 56 and 57, as shown in Fig. 4. A small piece of thin fibre must be glued to the underside of the Strip 55 for insulating purposes.

The ratchet for holding the rack in a raised position is built up as shown in Fig. 4, and it is weighted on one side with three $3''$ Strips 58. The $1\frac{1}{2}''$ Strip 59 must be adjusted so that when the chiming rack falls for the hour chime it is pressed down. This releases the ratchet and allows the striking rack to fall, thereby closing the contacts 56 and 57. When the Motor 4 has finished turning, the motor 3 starts up and operates the gathering pallet 60 in a clockwise direction. This picks up the rack, tooth by tooth, until it reaches its topmost position, when the motor is stopped by the contacts 55 and 56 opening. The point of the gathering pallet consists of a Silver Tipped Contact Screw.

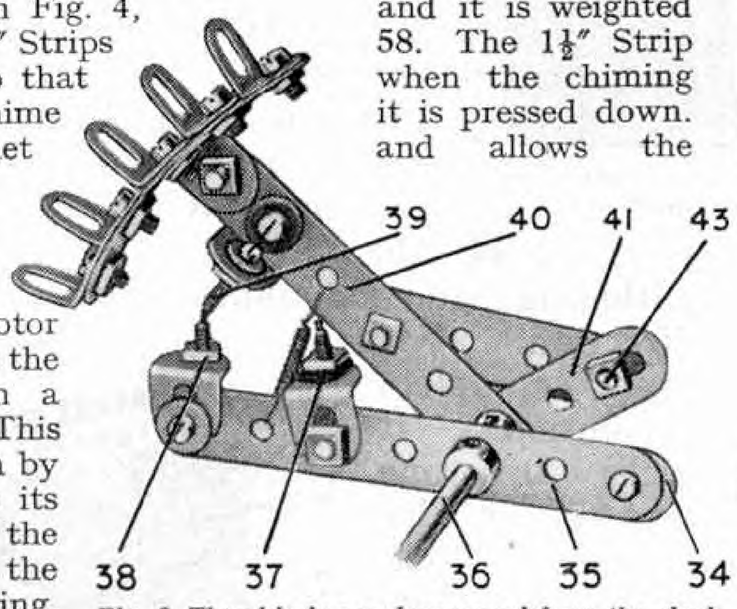


Fig. 6. The chiming rack removed from the clock.

The connections for this section of the mechanism start at the terminal 46, from which a wire is taken to the contact 23. A second wire is taken from 37 to a terminal 61, and from here a connection is taken to the contact 57, and from 56 to the insulated terminal of the motor 3. The gears for operating the hour hand are arranged in a similar manner to those of the Grandfather Clock, Instruction Leaflet No. 14A.

The mounting for the upper end of the pendulum is shown in Fig. 5, together with the striking contacts 63 and 64. The transmitter contacts, operated from the Collar 10, are also shown at 65 and 66.

The pendulum, which is $39\frac{1}{2}''$ in length and carries a "bob" consisting of a Boiler with Ends, filled with scrap lead, is energised by the mechanism shown in Fig. 3. The operation of this is identical with that employed in the Pul-syn-etic Clock described in the "*M.M.*" for April last.

The hammer mechanism shown in Fig. 7 is now constructed. The base consists of two $9\frac{1}{2}''$ Angle Girders arranged parallel and connected together at each end by a $3\frac{1}{2}''$ Angle Girder supporting a $2\frac{1}{2}''$ and a $3''$ Strip. These two Strips are arranged as shown in the illustration, and at their upper ends are fitted with a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket.

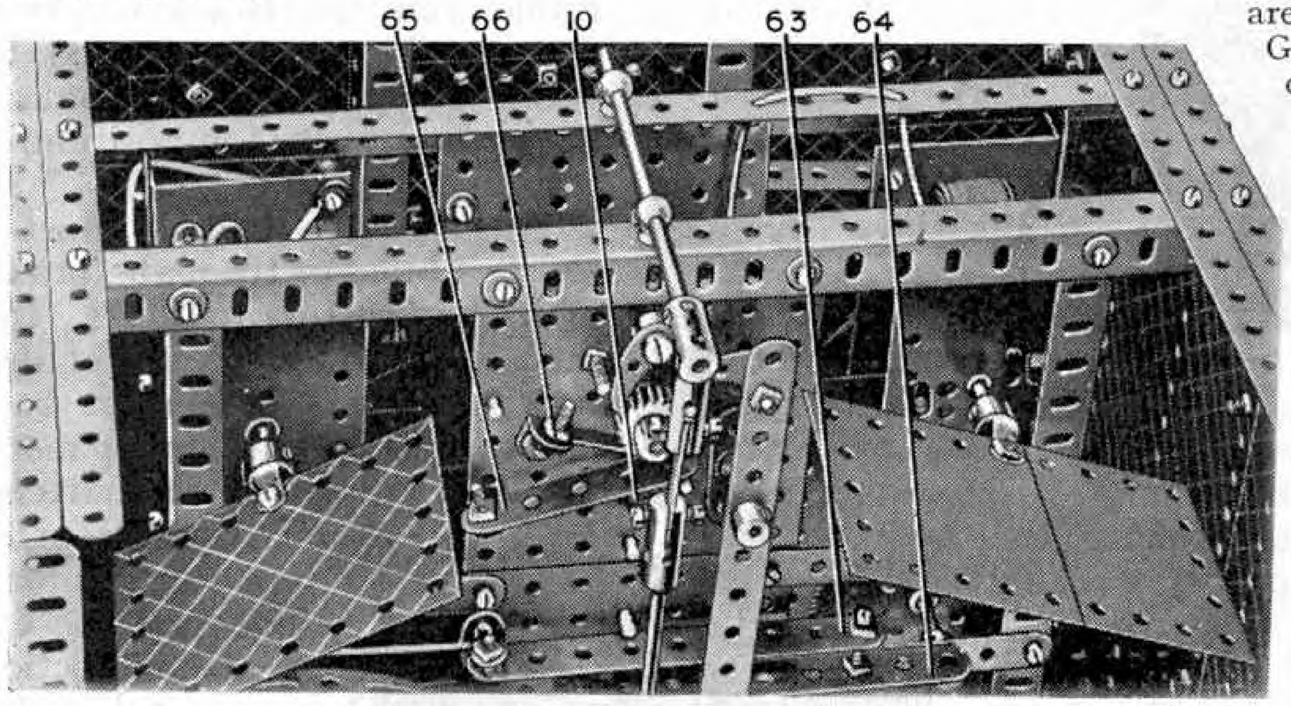


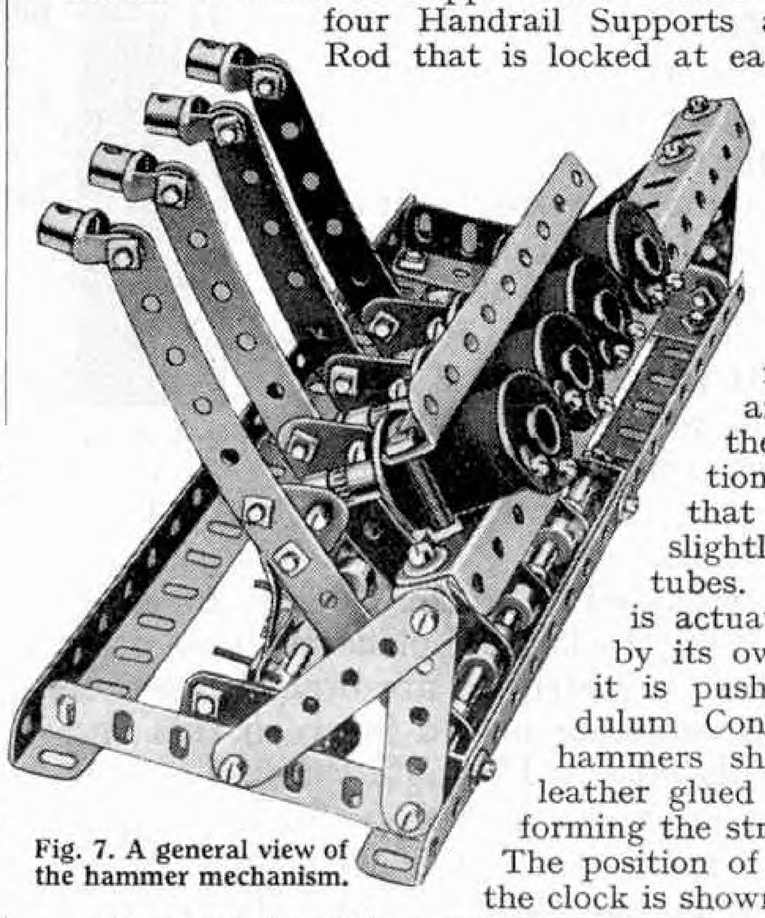
Fig. 5. In this view the governor fans are shown.

The two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets are connected by two $5\frac{1}{2}''$ Angle Girders, bolted together and overlapping five holes. This compound girder supports the four solenoids used for actuating the hammers, and solenoids are clamped in place by a $4\frac{1}{2}''$ Angle Girder attached to the compound girder by five $1''$ Screwed Rods.

The hammers are now fitted, and the pivot for these consists of a $4\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip and a $5''$ Rod. The Double Angle Strip is bolted to one of the base Girders of the mechanism and the Rod is journalled in the two turned-up ends of the part. Collars are used to prevent the Rod from moving sideways. The hammer levers consist of four $5\frac{1}{2}''$ Curved Strips mounted pivotally on the $5''$ Rod between pairs of Collars.

Each lever has a $1''$ Triangular Plate bolted to it as shown, and this plate supports a Collar by means of a set screw. The screwed portion of an Elektron Magnet Core is passed into the plain hole of the Collar, and is held in position by the set screw. Great care must be taken when lining up each hammer and Magnet Core, for if they tend to jam, the tone and volume of the note will be impaired.

The hammers are kept in the position shown in Fig. 7 by means of Pendulum Connections. These are attached to Flat Brackets by 6 B.A. Nuts and Bolts, and the Brackets are carried on the shanks of Handrail Supports and locked in place by nuts. The four Handrail Supports are carried on an $8''$ Rod that is locked at each end in the boss of a Double Arm Crank. This Crank is bolted to a $1\frac{1}{2}''$ Angle Girder that in turn is bolted to its respective $3\frac{1}{2}''$ Angle Girder of the framework.


Fig. 7. A general view of the hammer mechanism.

When the hammer mechanism is complete and fitted in the clock, the Pendulum Connections must be so arranged that they hold the hammers slightly away from the gong tubes. Thus when a hammer is actuated it strikes the tube by its own weight, after which it is pushed clear by the Pendulum Connection. Each of the hammers should have a piece of leather glued over the End Bearing forming the striking head.

The position of this mechanism in the the clock is shown in Fig. 3.

In order to reduce mechanical noises to a minimum in the hammer movement thin pieces of soft india rubber may be glued in place at the necessary points. A piece glued to each Magnet Coil cheek, at the point where the $1''$ Triangular Plate of the hammer hits it, will reduce unwanted noise considerably. Similar pieces can be fitted to the upper ends of the Pendulum Connections.

A good deal of noise is caused also by the "warning," especially at the hours. Carefully placed pieces of rubber will also do much to reduce this, and a short length of small diameter rubber tubing passed over the smooth portion of the Threaded Pin 43 will help considerably.

Owing to lack of space the construction of the clock case has not been described. Any model-builder who experiences difficulty in this should write to the Editor for details.

Novel Ideas for Model-Building

Models with No. 2 Motor Car Outfit and Meccano

MECCANO Motor Car Constructor parts are designed essentially for reproducing different types of sports cars, but it should not be thought that the applications of the parts are limited to the models shown in the Instruction Leaflets supplied with the Outfits. In a special article last month two examples of new models built with No. 1 Outfit parts were illustrated, and on this page we show the possibilities of the No. 2 Motor Car Outfits when used in conjunction with standard Meccano parts.

By introducing Meccano parts to models built with the Motor Car Outfits a fascinating field for new ideas is opened up, and many varied types of vehicle can be built in this manner. The two models illustrated are of totally different types, and serve to show how the parts can be combined to produce realistic results. Many other interesting models can be built on similar lines, and all owners of Motor Car Outfits should try this novel way of designing new models.

The Motor Car parts are not provided with standard Meccano perforations, the holes being made to take 6 B.A. Bolts; but by using the Insulating Bushes and Washers in the Elektron range, Meccano parts can be bolted to them quite satisfactorily.

The two-seater coupé on this page is built on a short wheelbase by omitting the Body Centre Section, and is fitted with the Rounded Rear Section. The Mud-guards complete with Running Boards are used, and in other details the model is similar to those shown in the Instruction Leaflet.

The coupé head must be fitted in place before the Clockwork Motor and Underside Sections are bolted in their respective positions. A $2\frac{1}{2}$" small radius Curved Strip is bolted to each side of the model immediately behind the driver's seat, and these are each extended by a Flat Bracket. The Curved Strips are fixed by the $\frac{1}{4}$" 6 B.A. Bolts contained in the Motor Car Outfit, but Insulating Bushes are fitted on each Bolt beneath the head. The Flat Brackets are connected together by a $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip that carries two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates and two Obtuse Angle Brackets. The Flexible Plates are curved round the $2\frac{1}{2}$" Curved Strips, to which they are attached by Angle Brackets, and thus form the saloon roof. A $2\frac{1}{2}$" Strip is bolted between the Obtuse Angle Brackets.

A $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip is fixed in place of the Windscreen and is curved slightly to fit closely to the upper surface of the dash. It is fixed by a 6 B.A. Bolt inserted through the holes in the Instrument Board and Dash, and carries a $1\frac{1}{2}$" Strip at each end. These Strips are bolted to the ends of the upper Double Angle Strip already mentioned.

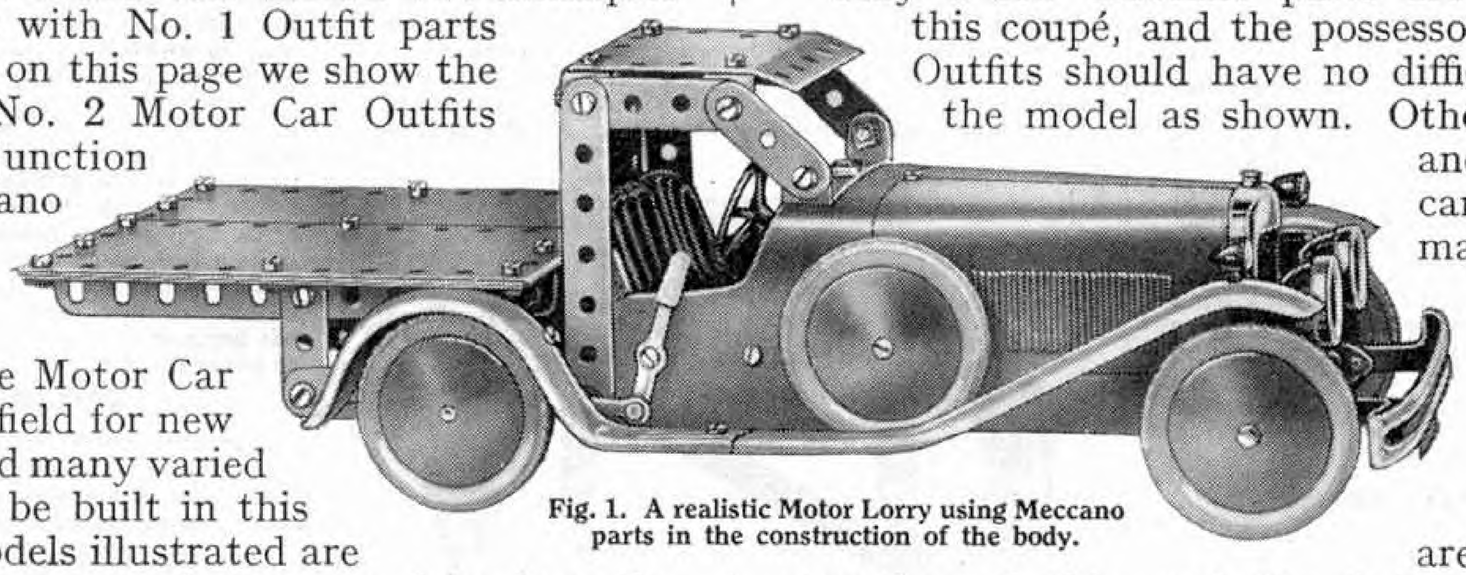


Fig. 1. A realistic Motor Lorry using Meccano parts in the construction of the body.

Only a few Meccano parts are necessary to make this coupé, and the possessors of small Meccano Outfits should have no difficulty in reproducing the model as shown. Other models of saloons and open four-seaters can be built in a similar manner by combining Meccano and Motor Car parts.

Quite a different type of model is shown in Fig. 1. More Meccano parts are used in the construction of this, and the finished model closely resembles a modern light truck. This serves to show that commercial vehicles also can be reproduced realistically, and in this class there are many types that can be built on similar lines to the model shown.

To build the model the front part only of the car is put together as described in the leaflet. The rear ends of the Frame Side Members are held together rigidly by the Clockwork Motor, and are extended by $1\frac{1}{2}$" Strips that are attached to the end holes of the Side Members by 6 B.A. Bolts carrying Insulating Bushes. These $1\frac{1}{2}$" Strips can be seen in the illustration, and vertical $1\frac{1}{2}$" Strips are bolted to them. The latter support $4\frac{1}{2}$" Angle Girders bolted beneath the platform body, which is formed from two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plates strengthened at the edges by $5\frac{1}{2}$" Strips and by $3\frac{1}{2}$" Strips at the rear. The front of the platform is attached by a $2\frac{1}{2}$" Angle Girder to the $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate at the rear of the cab.

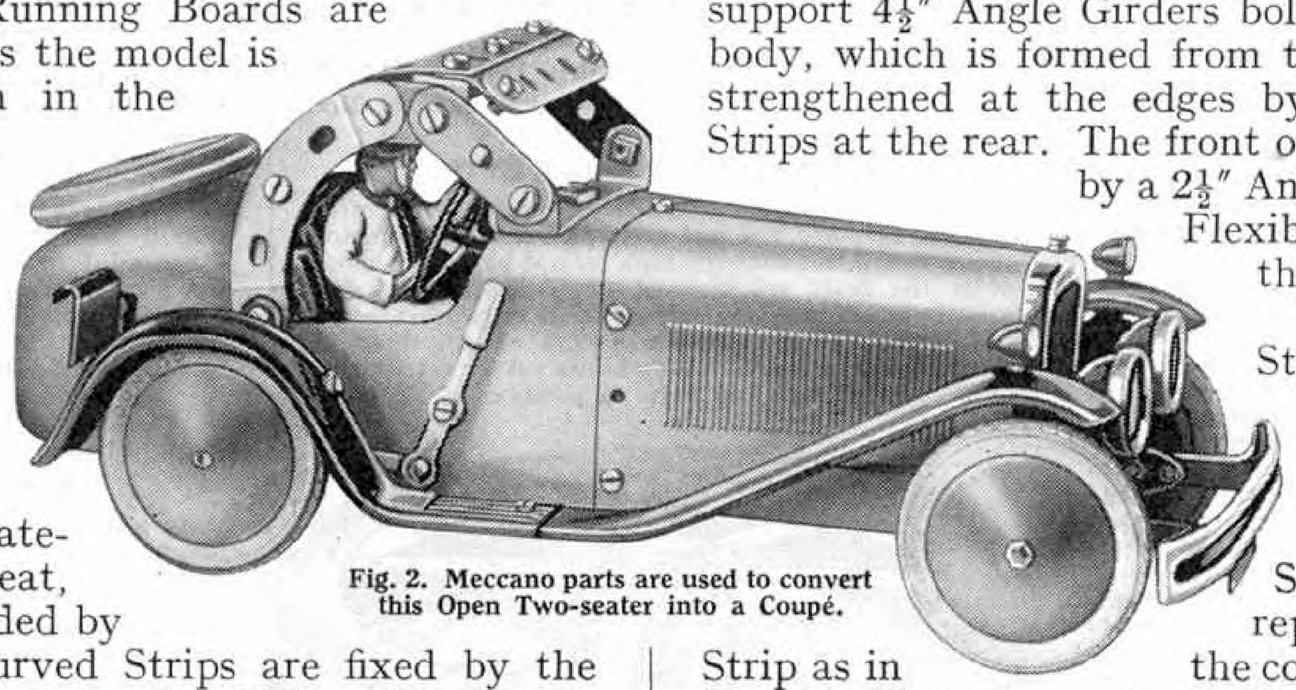
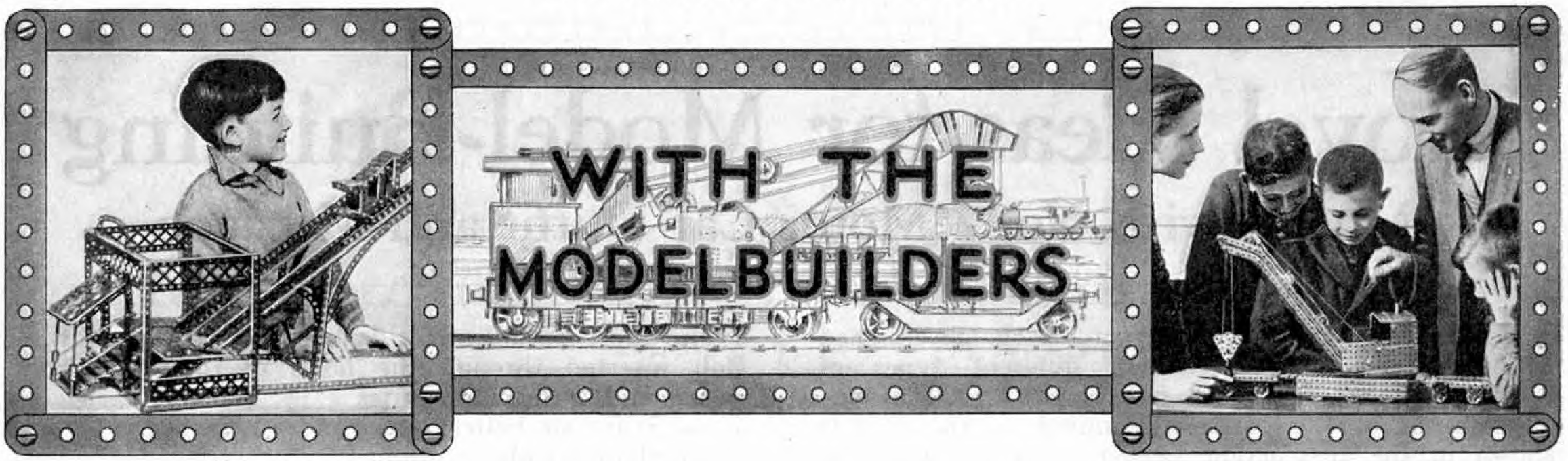


Fig. 2. Meccano parts are used to convert this Open Two-seater into a Coupé.

The arrangement of the Strips forming the sides of the cab can be seen, and these are connected together at the top by $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. The Windscreen is replaced by a Double Angle Strip as in the coupé model, and a $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plate is used for the cab top. A $3\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plate is attached to Angle Brackets to fill in the space at the back of the cab.

Ideas for other vehicles built up in this way will readily occur to the model-builder. Many commercial vehicles of the lighter type can be built without difficulty and almost all types of private car can be reproduced by exercising a little ingenuity. After some of the more common designs of body have been built the constructor should try building streamlined bodies conforming to modern practice.



MECCANO CHANNEL SEGMENTS

Part No. 119, Channel Segment, has been withdrawn from the Meccano range. This part was used chiefly for making large flywheels and for the races of roller bearing units, eight of the parts being necessary to make up a complete circle. The uses of the part are now covered by the Ring Frame, No. 167b, which is more satisfactory for the same purposes. In each of the Meccano Outfits Ha, K and Ka, eight Channel Segments were included, and these will now be replaced by one Ring Frame in each case. Outfit L contained two sets of eight Channel Segments, for which two Ring Frames will be substituted. The Ring Frame is far more rigid than a circle built up from Channel Segments, and produces a flywheel free from buckle. Owing to the absence of joins in the Ring Frames, roller bearings built up from these parts are smoother in operation than those using Channel Segments.

A FLYWHEEL FROM RING FRAMES

The method of building a heavy flywheel from two Ring Frames is shown in the lower illustration on this page. This construction is suitable for replacing flywheels built up from Channel Segments. Two Ring Frames are used for the rim of the wheel and are bolted together by eight 1½″ Strips. Eight spokes at each side of the wheel are formed by 5½″ Strips that are bolted to Face Plates spaced apart by 1½″ × ½″ Double Angle Strips. In the Outfit K models of Watt's Beam Engine and Mill Engine, only one Ring Frame is available for the flywheel, and in this case it is attached to a Face Plate at the centre by four 4½″ Strips and four sets of two 2½″ Strips overlapped two holes.

BUILT-UP ROLLER BEARING

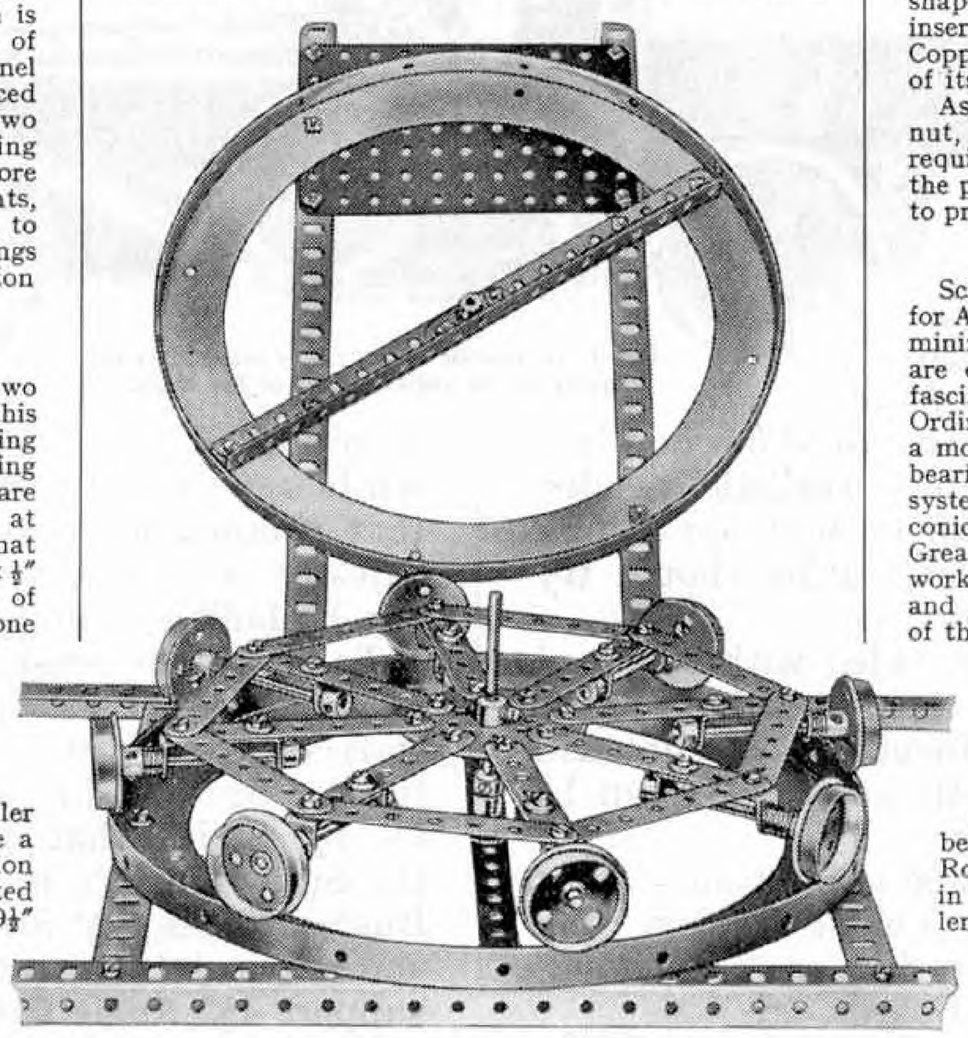
Ring Frames make a far more satisfactory roller bearing unit than the Channel Segments, and give a very smooth turning motion. The upper illustration on this page shows how the parts can be incorporated in a model in place of the Channel Segments. A 9½″ Strip is bolted across the lower Ring Frame and has a Double Arm Crank secured to it. The Crank carries a Rod that is held in place by two Collars, and passes up through the boss of a Face Plate at the centre of the frame carrying the rollers. Eight 3½″ Strips are bolted radially about the Face Plate, and their outer ends are connected by further 3½″ Strips. The radial 3½″ Strips are each fitted with a 1½″ × ½″ Double Angle Strip so that eight Rods radiate from the centre pivot. The Rods are 2½″ in length and carry Collars on their inner ends and 1½″ Flanged Wheels on their outer ends.

The Flanged Wheels are spaced from the Double Angle Strips by Washers, eight Washers being used on each of four of the Rods, and five on each of the other four. The eight Washers are fitted to the Rods that are journalled below the 3½″ Strips attached to the slotted holes of the Face Plates. The upper Ring Frame is shown at the back of the bearing in the illustration. In this case a 9½″ Angle Girder is bolted across the centre of the frame and carries at its centre a Double Arm Crank that passes over the vertical centre pivot Rod. The Angle Girders supporting the model are attached to this Girder and to the Ring Frame.

Rotation of the superstructure of a model mounted on this type of bearing can be effected by means of Sprocket Chain in a similar manner to that shown in models fitted with the old style roller bearing built up from Channel Segments. The Chain can be retained in position round the rim of the lower Ring Frame by means of Angle Brackets bolted to the frame, or by Reversed Angle Brackets secured to the base of the model. An alternative form of drive can be arranged with friction gearing. A 1″ Pulley Wheel fitted with Rubber Ring can be made to bear against the upper or lower Ring Frame according to requirements, or if a larger driving wheel is required a Pulley and Tyre may be used.

FIXING RODS TO ANGLE GIRDERS

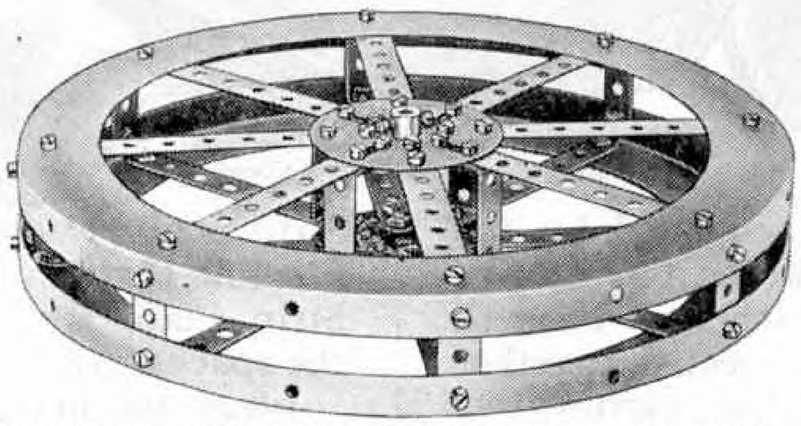
Rod Sockets are particularly useful for attaching Axle Rods to Strips, Girders or Plates, and by this means neat handrails can be built up. Rods fitted in the Sockets may be provided with Handrail Couplings at their upper ends, and these fitted with Rods forming the actual Handrails. In cases where it is required to fix an Axle Rod securely in the elongated hole of an Angle Girder, and where Rod Sockets are unsuitable or are not available, an alternative form of construction can be adopted. The Rod is passed through the slotted hole of the Girder, and a bolt is then inserted in the same hole and provided with a nut. As the bolt is screwed into the nut it will be found to lock the Rod firmly in place.



The Ring Frames are shown here in use as races for a large roller bearing.

PLACING INACCESSIBLE NUTS

In making totally enclosed structures it is often difficult to place the last nuts and bolts in position owing to the fact that the nuts cannot be held in place while the bolts are screwed in. This difficulty frequently arises in the construction of intricate models, and unless the constructor knows exactly how to proceed, he may spend many hours vainly attempting to secure the nuts and bolts in position.



This flywheel, built up from Ring Frames, can be used to replace flywheels made from Channel Segments.

There are several ways of inserting the last nuts and bolts in place. Sometimes the best procedure is to fix the bolts in position with nuts so that the last parts to be fitted can be placed over the shanks of the bolts and nuts then screwed down. Thus it is easy to remove the parts to enable adjustments to be carried out to the model if necessary. Where this method of construction is impracticable some means must be devised for holding the nuts in position inside the model while the bolts are inserted. Meccano Box Spanners (No. 34b) are particularly useful for holding nuts in awkward positions, and if the Spanner is not long enough it can be extended by means of Strips.

If the nut is to be placed in such a position that is inaccessible by the Spanner, a length of wire can be shaped to hold the nut and can be bent in order to insert it in almost any position. The 23 gauge S.C.C. Copper Wire (Elektron Part No. 1587), when stripped of its covering, is useful for this purpose.

As a last resort a spot of gum can be applied to the nut, which is then placed over the hole where it is required and left until the gum is dry. When assembling the parts in position the bolt should be inserted gently to prevent dislodging the nut before it is screwed home.

ANTI-FRICTION BEARING

Scientific models frequently require delicate bearings for Axle Rods so that friction is reduced to an absolute minimum. An instance where free-running bearings are essential is in the mounting of a gyroscope, a fascinating model subject for the experimenter. Ordinary Meccano Rods are scarcely suitable for such a model, but it is possible to make very free-running bearings with parts already included in the Meccano system. For this purpose an axle rod is filed to a conical point at each end, and is carried between Grease Cups, which are mounted in a Meccano framework by passing them through appropriate holes and securing them in position with nuts. The points of the rod, which should each form an angle of about 60°, are then inserted in the holes in the Grease Cups. Only a very small frictional area forms the bearing for the rod, and as this is practically at the centre the retarding effect is almost negligible, also, the bearings are kept constantly lubricated by the grease in the Cups.

An alternative method, which will generally be found more satisfactory than the use of one Rod pointed at both ends, is to use two Rods fixed in Couplings or Rod Sockets. In this way the effective length of the rod can be increased or decreased slightly for adjustment.

BALL AND SOCKET JOINT.—Proposals for the introduction of a ball and socket joint in the Meccano system have already been put forward but the idea has been rejected owing to the limited use of such a unit and to the comparatively high cost of production. It is at present possible to reproduce a joint of this kind by using a Socket Coupling in which a Handrail Support or a Handrail coupling is fitted. If it is required to obtain flexibility of movement for the Handrail Support without rotation independent of the Socket Coupling, a Grub Screw can be fitted into one of the tapped holes in the head of the Handrail Support so that it projects slightly and engages the slot in the Socket Coupling. A second Grub Screw should be added to lock the first in place, but should fit flush with the Handrail Support. (*Reply to B. Booth, Bristol.*)

A HIGH-SPEED MECHANISM

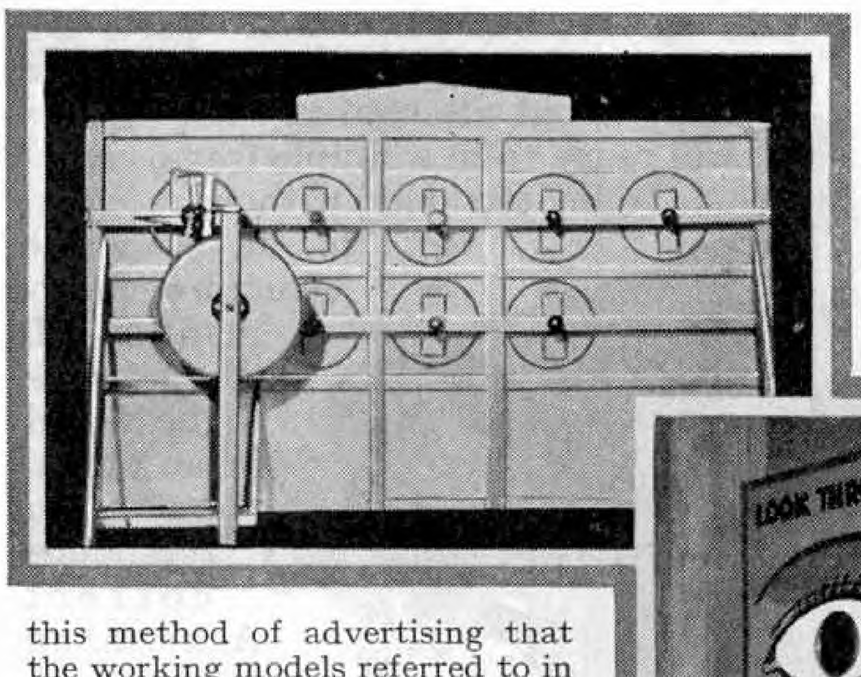
An interesting attempt to set up a speed record for Meccano mechanisms has been made by Brian Salisbury, East Sheen, London, who has built a gear-box by means of which a 2″ Pulley is turned at a speed of more than 32,000 r.p.m. The dimensions of this gear-box are 9½″ × 3½″ × 3″. It has a train of gears giving a total step-up gear of 213.15:1, but for starting-up purposes this ratio can be reduced to 142.1:1 by moving a gear change lever. A handle is provided to rotate the gear wheels. This consists of a 5½″ Strip fitted at one end with a Coupling and bolted at the other end to a 2″ Pulley Wheel secured on the primary shaft of the gear-box. The record-breaking 2″ Pulley is carried on the final shaft. Possibly other Meccano model builders may be sufficiently interested to carry out experiments in this direction, and we shall be pleased to hear the results.

In constructing these high-speed units great care must be taken when securing the gears on the axles, especially those gears situated on the slow moving shafts. These gears must all be fitted with double grub screws, and where necessary they should be duplicated. Reinforced bearings are also desirable, and they can easily be built up from Double Arm Cranks fitted with Grease Cups.

Meccano as an Aid to Cinema Advertising

Further Examples of Publicity Models

IN the May *"M.M."* we described a number of working model "cutouts" incorporating Meccano Gears and other parts, that were built up by the management of a large cinema and used for advertising various films. Ordinary wooden cutouts of cinema stars are frequently displayed in the entrances of picture houses, and when they were first introduced some years ago they attracted considerable attention and provided a splendid means of advertising the film being exhibited. The novelty has now worn off, however, and this form of publicity has lost much of its value, principally owing to the lack of movement. It was with the object of revivifying this method of advertising that the working models referred to in the May *"M.M."* were built up, and they proved very attractive and successful in operation.



Two views of the "Magic Eye" model described on this page are shown in the centre illustrations below. The model was made by Mr. P. Valliere, Quebec, and used for advertising cinema films.

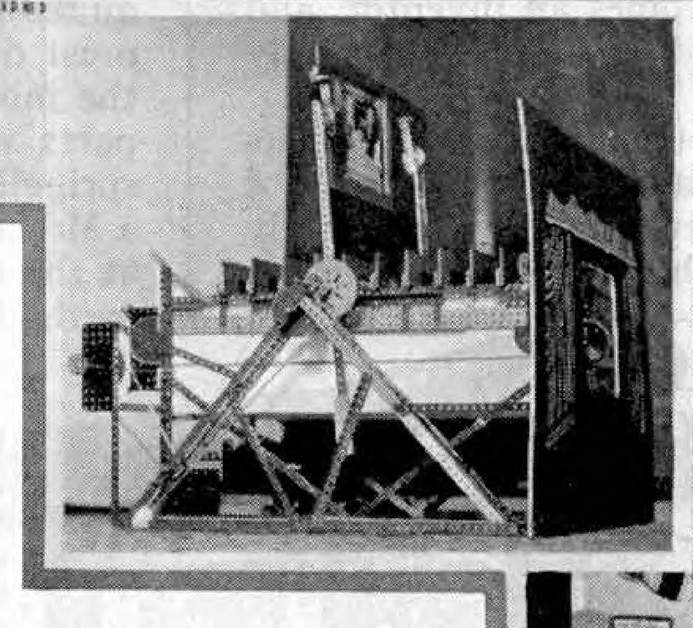
We have now received details of further models of this kind that have been designed by Mr. Paul Valliere of Quebec, Canada, and displayed in one of Quebec's leading picture houses. Some of these models are described and illustrated on this page. The top and bottom pictures show an animated puzzle poster that was used to advertise the film *"Gold Diggers of 1933."* The model consists essentially of a large poster bearing the title of the film. Several small discs cut in the poster are rotated slowly so that the letters of the wording are all jumbled up, but once in each revolution all the discs come into their correct relative positions, so that the title of the film can be read. It is most fascinating to watch this model in action, and the mechanism by which it is operated is very simple.

The front of the model is one of the usual film publicity posters pasted on to a sheet of plywood, strengthened at the back with battens. Several large discs are cut in the board in such positions that they bear portions of the lettering of the poster. Two rigid strips of wood are secured behind the board, and at the back of each disc is a Face Plate, which enables a spindle to be attached to the disc. The spindles pass through the strips of wood and are each provided with a $1\frac{1}{2}$" Sprocket Wheel, all these Wheels being interconnected by Sprocket Chain.

A large wooden pulley wheel, mounted behind the board, is driven by means of a length of Spring Cord from a Pulley on the output shaft of a Meccano Electric Motor, and the large wooden pulley drives the discs by Sprocket Chain. The top illustration shows the back of the model, and in the bottom illustration the discs are seen turned so that the letters are all jumbled up.

The centre illustrations on this page show the cabinet and mechanism of another ingenious machine, which Mr. Valliere named *"The Magic Eye."* On the front is a representation of a large eye, the pupil of which consists of a lens. Behind the lens is a miniature stage and proscenium about 10 in. wide and 8 in. high, at the rear of which is an automatic machine that manipulates a series of photographs and places each one in succession on the stage, so that it is framed by the proscenium. The pictures represent incidents from the film it is desired to advertise, and are changed by the mechanism every few seconds. The photographs are mounted in rigid holders at the back of the stage, and are held vertically between two endless lengths of Sprocket Chain.





The illustration on the right and that at the top show front and back views of Mr. P. Valliere's working model for advertising the film "Gold Diggers of 1933."

The chains are driven with an intermittent motion and carry the photographs forward until the foremost one is right up against the proscenium, where it can then be seen through the lens. The picture remains in this position for a few moments, and then two arms move downward and grip the front photograph and its holder and carry it upward and backward, lifting the frame from the chain and depositing it in its original place at the back of the stage. Meanwhile the next photograph is carried by the chains into position behind the proscenium, and this performance is repeated continuously until the full set of pictures has been displayed.

When the machine was first exhibited at the cinema one of the sides was left open so that the mechanism could be seen in operation. This attracted a good deal of attention, and many people were as much interested in finding out how the model worked as in looking at the pictures!

A film entitled *"As the Earth Turns"* gave Mr. Valliere another opportunity for exercising his ingenuity. This model is in the form of an orrery and is operated by an Electric Motor. A globe representing the Earth is mounted on a Rod that is inclined at the correct angle to the horizontal and driven from the Motor through a horizontal shaft and Universal Couplings. A Socket Coupling loose on the Earth's axis is driven from a second horizontal shaft and carries a piece of stout wire, to which is fixed a second globe that represents the Moon. The two horizontal shafts turn at different speeds and cause the Earth to rotate on its axis and the Moon to move in an orbit round the Earth. In addition to these movements both the Moon and the Earth turn round a lighted electric lamp that represents the Sun.

A Meccano orrery similar to this model was illustrated in the June 1927 *"M.M."* and also in the 1928 *"Book of New Models."*



For advertising a film entitled *"The Kid from Spain,"* Mr. Valliere constructed a working poster model showing a bull and a matador in action, an amusing effect being obtained by causing the bull to raise its tail, lower its head, and then charge the matador. The legs, arms and head of the matador and bull are pivoted on Rods, and are all connected by means of cords to levers, which are operated by cranks and cams. Some parts of the model move with a slow steady action, and these are driven by cranks, but other parts such as the bull's tail and the matador's sword arm, which move quickly and intermittently, are actuated by cams. The various moving portions are made to return into their original positions at the end of each cycle of operations by means of Springs.

In Search of New Models

Motor Cars Form Attractive Subjects

KEEN model-builders do not rest content with building models from Instruction Manuals, but spend many happy hours in designing models for themselves. They know what fun it is to create models of their own. There is the interest in choosing a subject for the model, the fascination of planning how it will be built and of selecting the parts to be used in the construction of the various details, and finally the pride of achievement when the model is completed and set in motion by means of a Meccano Clockwork or Electric Motor.

The constructor gets the greatest fun from his Outfit when he is designing models of his own, regardless of the size of the Outfit. Of course the newcomer to the ranks of Meccano enthusiasts, who is building models for the first time, should start by copying the Manual Models, as in this way he will become familiar with the uses of the different parts. Eventually, however, he will try altering some of the models according to his own ideas, and later will design entirely new models for himself. At this stage he becomes an inventor, and finds that the true joys of model-building have only just begun.

There is unlimited variety in the range of subjects that can be reproduced in Meccano, and the choice of any particular prototype for a new model will naturally depend upon the inclinations of the constructor. Having decided what to build, the model-builder should obtain as much information as he can about the chosen prototype. This may be had from books, periodicals, or from inspection of the actual subject. The amount of detail work that can be incorporated will depend upon the range of parts available, and with small Outfit models it is usually the case that only the general outline can be reproduced. The builder of small Outfit models is thus not concerned with internal details, and consequently is able to build a model from perhaps only one general view of the actual subject. Those with larger Outfits must obtain information concerning the inside details of the subject, or they can design these parts for themselves, and motors also can be used for driving their models.

An extensive field for model-building is provided by the many different types of motor car that are in daily use. A glance through any motoring periodical will show the constructor that he has a very wide range of subjects from which to choose a prototype for a new model. These cars range from small two-seaters in the "baby" car class to large and powerful limousines. There is great variation in the types of body fitted to the different makes, so that the model-builder never need be short of a subject for a new Meccano motor car.

The method of procedure in designing a new model car depends largely upon the size of the Outfit that is available. For the very small Outfits the body and chassis will be built as one, but where more parts are available the chassis should be built first and the body fitted afterwards. The chassis will range from a simple frame carrying the axles, without mechanism, to an elaborate structure incorporating all the features to be found in an actual car. To reproduce correct Ackermann steering gear, clutch, gear-box and differential, etc., requires an extensive range of parts, and the constructor must decide what detail work must be omitted so that the model can be built with the parts at hand. If the parts will allow, the chassis should be provided with springing and steering gear of Ackermann type; and if a Meccano power unit is available this may be mounted at the front and made to drive the rear axle. A simpler method is to fit the Motor at the rear of the model so that it can be coupled direct to the axle, but this arrangement is unsuitable when the rear axle is mounted on springs.

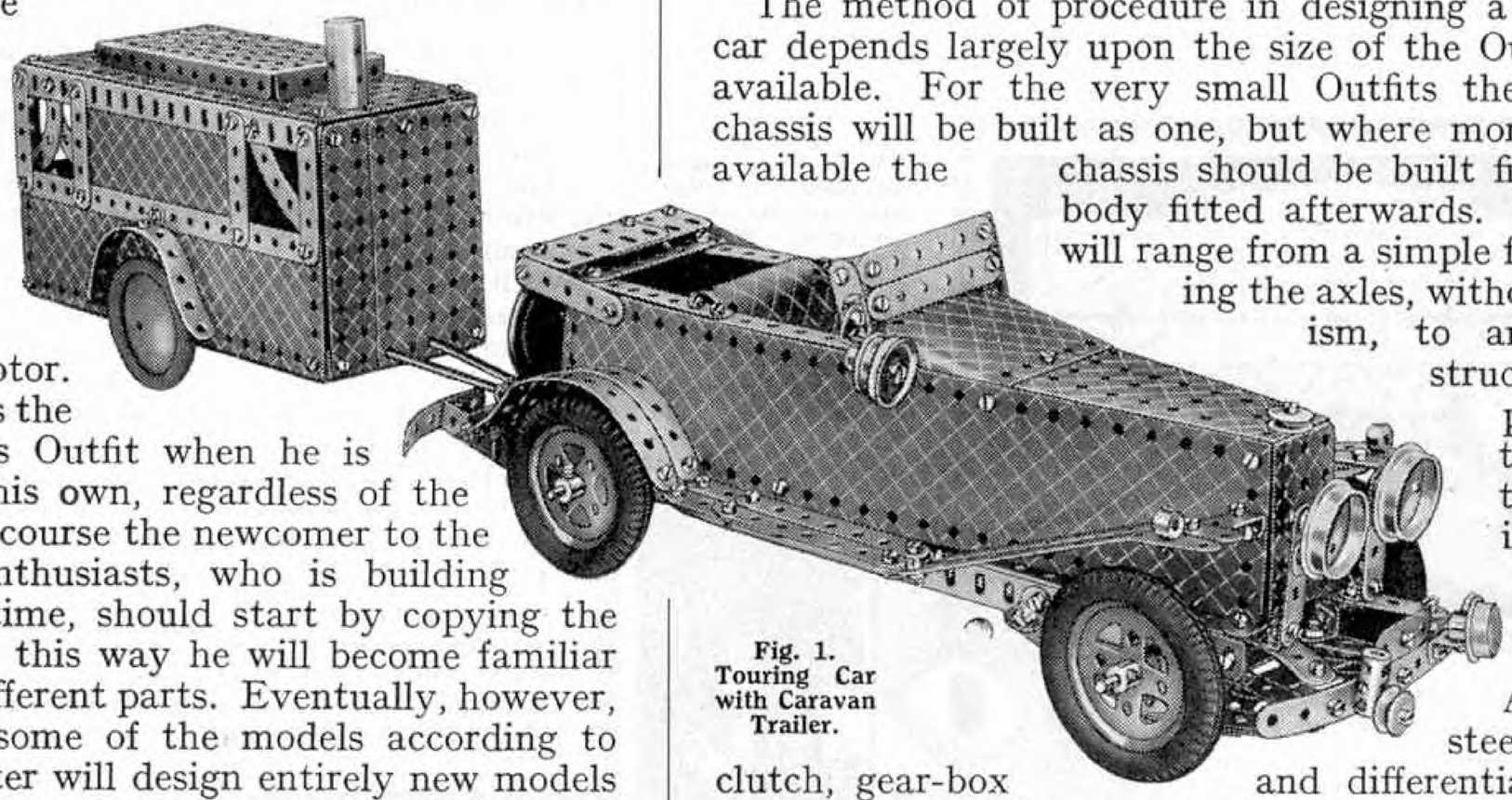


Fig. 1. Touring Car with Caravan Trailer.

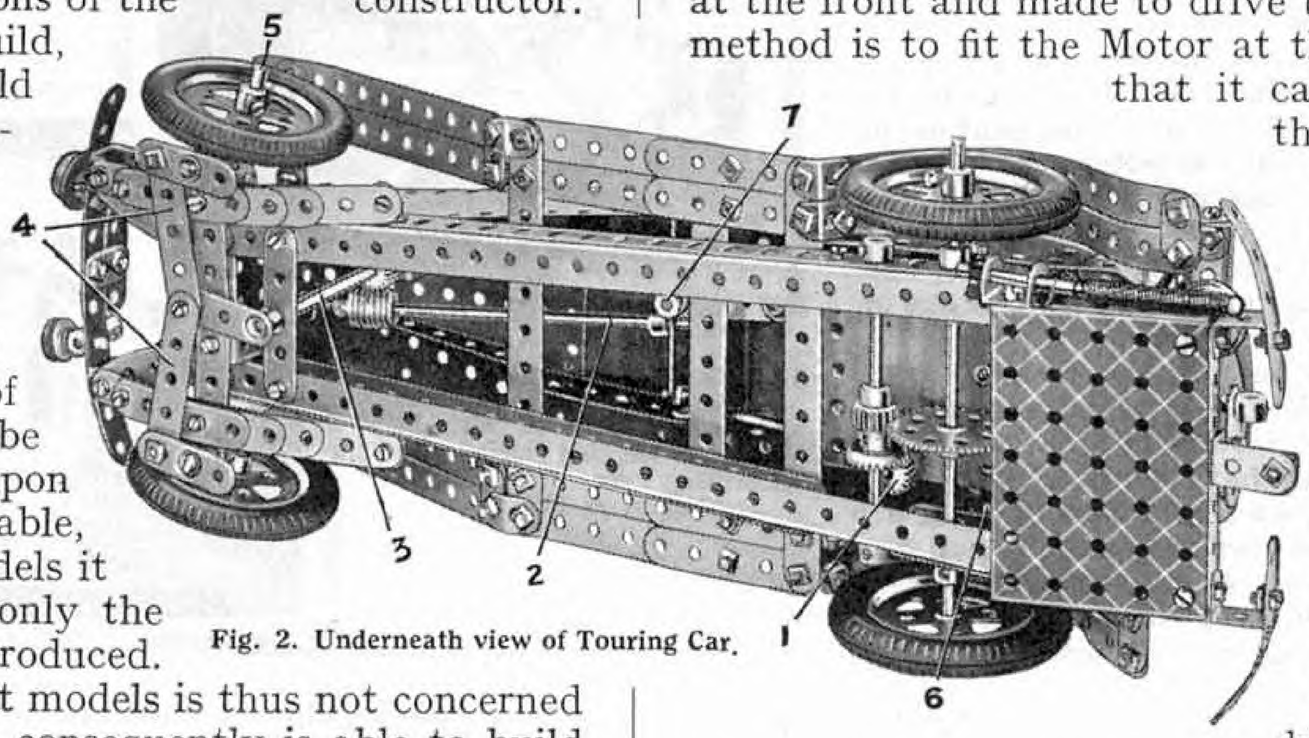


Fig. 2. Underneath view of Touring Car.

Figs. 2 and 4 show two different methods of building a model car with an Outfit H. In Fig. 2 a chassis is built up, fitted with leaf springs at the front and steering gear, and having a rigidly-mounted rear axle driven from the No. 1 Clockwork Motor fitted on the rear of the chassis. The other model (Fig. 4) is not provided with a chassis, and the Clockwork Motor is mounted in the body to drive the rear axle direct. These illustrations give an idea of the different lines that can be followed by the designer, and the type of model that is being built will generally govern the particular methods of construction that are adopted. A much simpler model is shown in Fig. 5, and in this case a Flanged Plate, extended by Curved Strips,

forms the chassis, and the size of the model and the limited range of parts available will not permit the fitting of steering mechanism.

Much interesting work can be expended on building the body, and the new Strip Plates and

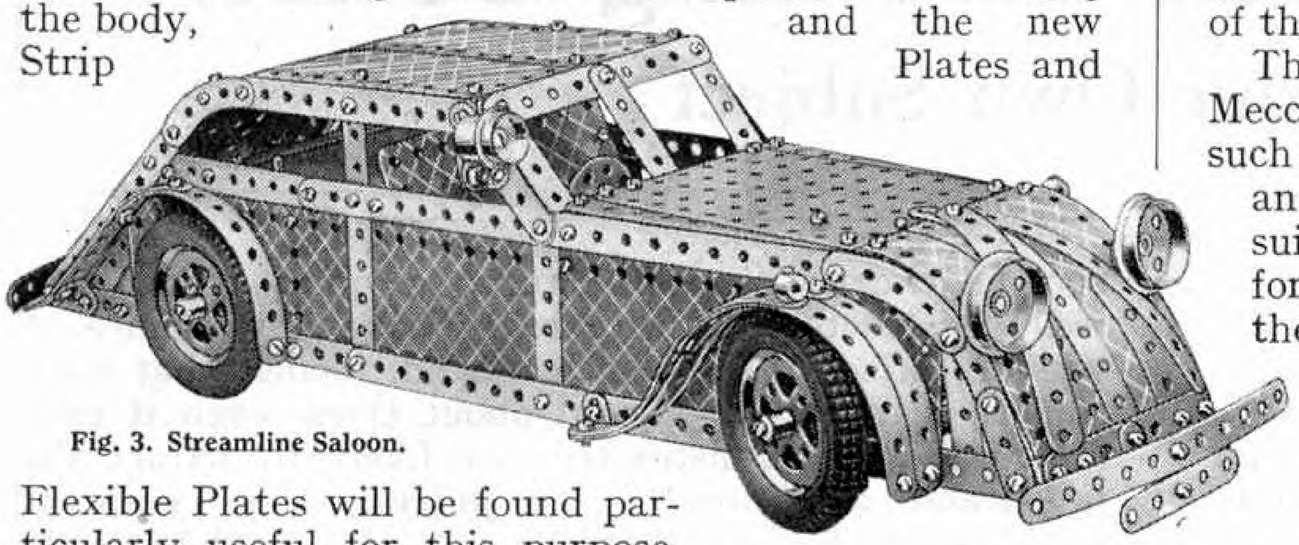


Fig. 3. Streamline Saloon.

Flexible Plates will be found particularly useful for this purpose.

The Flexible Plates are most useful owing to the ease with which they can be used for obtaining the curves characteristic of modern body design. Three distinct types of body are shown on these pages, and in each case the Flexible Plates prove their utility. In the Four-seater Tourer and the Two-seater Sports Car Flexible Plates are used also for the seats. An unorthodox type of body is shown in Fig. 3, which is a representation of the streamlined bodies that are now fitted to several makes of car.

The appearance of the finished model is greatly improved if due attention is paid to the amount of external detail that is incorporated. Essential details for all cars are the lamps, and simple models may have two headlamps only. More advanced models may be fitted with several others. The Touring Car in Fig. 1 has headlamps, side lamps, rear lamp, spotlight and fog lamp, all helping to give the model a finished appearance. Extra accessories adding realism to the model are the dummy electric horn on the front bumper, filler cap on the petrol tank, and spare wheel. Bumper bars are fitted to most present-day cars and consequently should form part of the equipment of a Meccano model. Different types of bumper are shown in the illustrations.

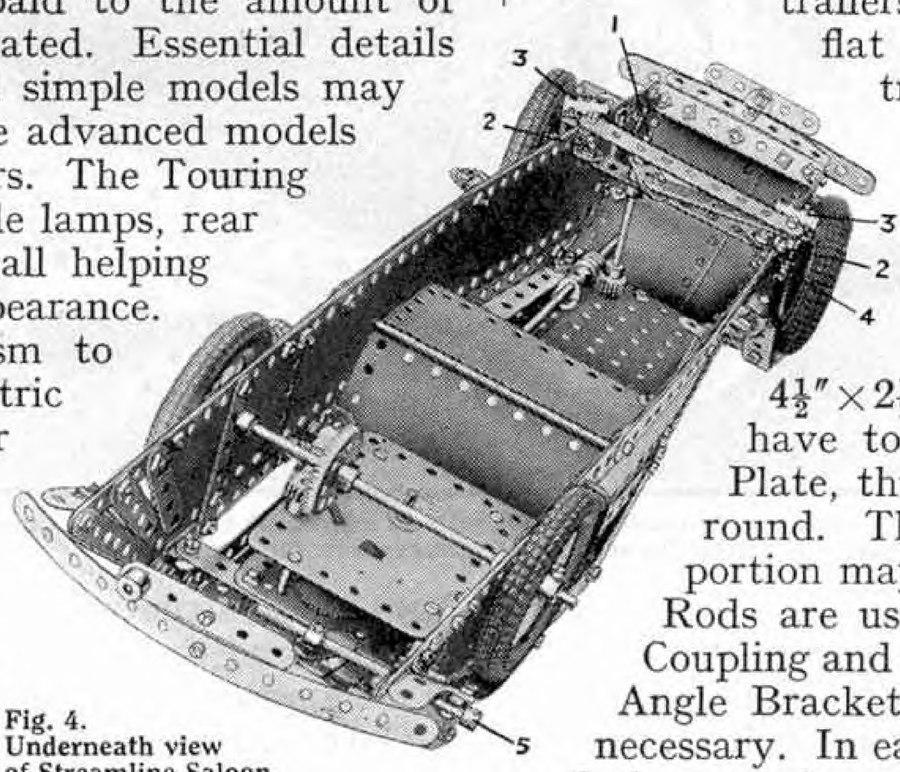


Fig. 4. Underneath view of Streamline Saloon.

Some form of steering gear should be fitted to the model if possible, and two different methods of reproducing Ackermann steering are shown in Figs. 2 and 4. In the former illustration, showing an underneath view of the Touring Car, the steering column 2 operates a vertical Rod 3 through Worm and Pinion, the lower end of the vertical Rod being fitted with a Crank. Two pivoted connecting links 4 connect this Crank to Double Arm Cranks attached to the pivots for the stub axles. Each Double Arm Crank is gripped on a $\frac{3}{4}$" Bolt that passes through the front axle and is inserted in a Coupling carrying one of the stub axles. Two $4\frac{1}{2}$" Strips are used for the front axle, and are secured face to face but spaced apart by a Washer on each fixing bolt.

The steering gear on the Streamline Saloon (see Fig. 4) is arranged somewhat differently. The Rod 1 is operated through Worm and Pinion from the steering column and carries a Crank at its lower end. The $1\frac{1}{2}$" Rods 3 are free to turn in Double Brackets, and carry Collars 4 on their upper ends and Couplings on their lower ends. The front wheels are mounted on $\frac{3}{4}$" Bolts inserted in the Collars 4, and each wheel is spaced from its Collar by four Washers. The $1\frac{1}{2}$" Rods 2 are inserted in the centre holes of the Couplings and carry Collars between which a $4\frac{1}{2}$" Strip is pivoted. A 3" Strip forms a connecting link between the Crank on the Rod 1 and one of the Collars.

The interest of a model car is greatly increased if a Meccano Motor is fitted to drive it. For a small model such as that shown in Fig. 5 the new *Magic* Motor forms an excellent power unit. This motor is particularly suitable for small models, and owing to its compact form can be incorporated without difficulty in most of the small Outfit models. The $\frac{1}{2}$" Pulley and rubber driving bands that are supplied with the Motor simplify the arrangement of the drive transmission. In each of the two larger models illustrated a No. 1 Clockwork Motor is used. Where a more powerful drive, or a reversing movement, is required, either a No. 1a or a No. 2 Motor must be fitted.

An interesting addition is made to the Touring Car model by the caravan trailer shown in Fig. 1. This extra model is coupled up behind the car by passing a Coupling on the caravan drawbar over a Threaded Pin secured to the rear of the car by a 1"×1" Angle Bracket. There is much fun to be derived from the addition of accessories such as these. Caravan trailers are made in various designs and offer scope for ingenuity on the part of the model-builder. Some of the larger trailers have four wheels, whereas some of the smaller two-wheeled trailers are of the collapsible type and fold flat for towing. Different types of open trailer are also seen in use for various purposes, and make interesting model subjects.

An excellent folding trailer can readily be constructed by building the bottom half only of the trailer caravan shown in Fig. 1. The two $4\frac{1}{2}$"×$2\frac{1}{2}$" Flat Plates at the forward end will have to be replaced by a $3\frac{1}{2}$"×$2\frac{1}{2}$" Flanged Plate, thus making the trailer $2\frac{1}{2}$" in height all round. The framework for the collapsible top portion may be built of either Rods or Strips. If Rods are used they must be secured together by Coupling and Swivel Bearings, but for Strips, Obtuse Angle Brackets and $\frac{1}{2}$"×$\frac{1}{2}$" Angle Brackets will be necessary. In each case the frame is covered with thin cloth or good quality paper. For towing, the framework is folded and placed in the trailer, which is then covered with the cloth or paper. In actual practice the canvas cover is so designed that it covers the entire trailer when the framework is folded.

Other interesting types of trailers for towing behind commercial wagons, etc., may be built to represent milk carriers. A unit of this type is usually built in two tiers from strong laths, the whole being carried on two wheels. They are used mainly for carrying milk churns in large numbers, but they may also be adapted to carry small livestock such as sheep, pigs, etc., by boarding in the floors.

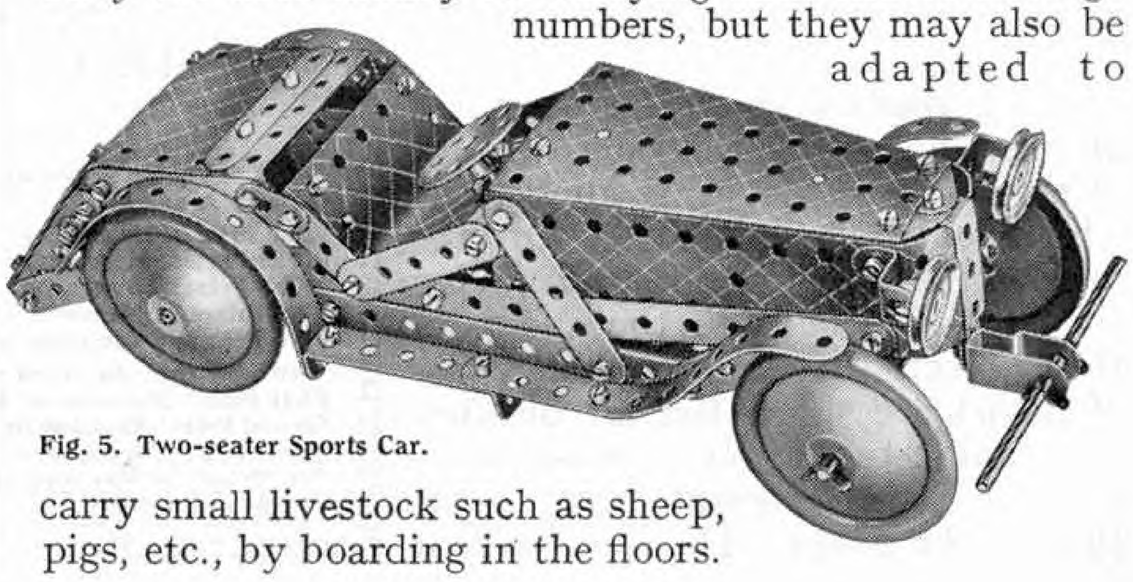


Fig. 5. Two-seater Sports Car.

"September" Model-Building Contest

Choose Your Own Subject

This month we are arranging another of the popular model-building competitions in which models of any kind may be entered, and we wish it to be clearly understood that the contest is open to every reader of the "*M.M.*," no matter what his or her age may be. The only condition governing entries is that models must be built entirely from Meccano parts. There are no entry fees to pay or forms to fill in. Some of the best models submitted will be illustrated in future issues of the Magazine, and others may be included in forthcoming Instruction Manuals and other publications.

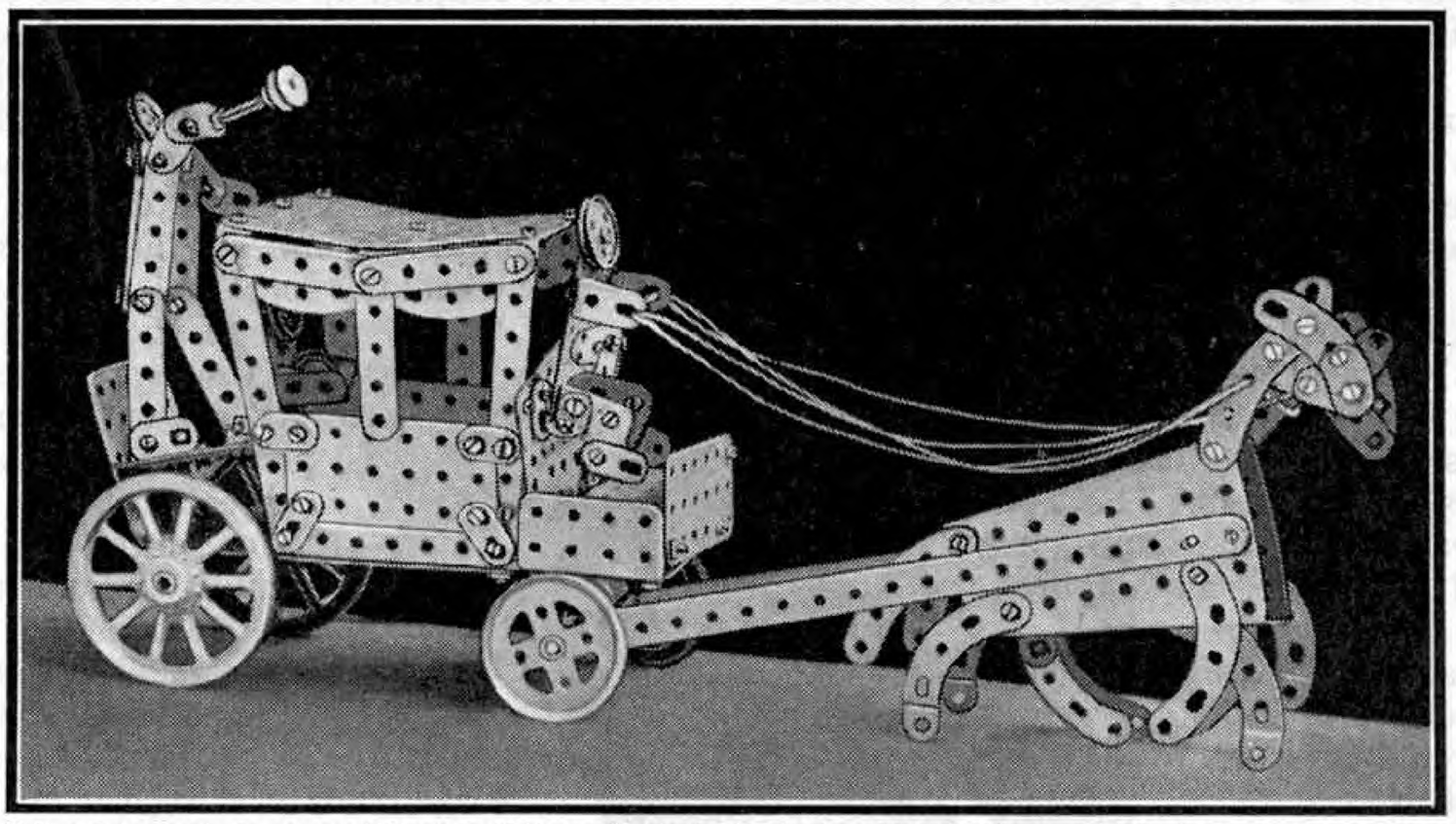
The object of these monthly competitions is to provide Meccano model-builders with opportunities of measuring their skill against that of other competitors, and at the same time to encourage readers to search for interesting new subjects for models.

Every "*M.M.*" reader who has a Meccano Outfit stands a fair chance of winning a prize in this contest. The size of the Outfit is taken into full consideration in awarding the prizes, so that those who have only small Outfits are on equal terms with those having K or L Outfits. Another important point is that the age of each competitor is taken into account, so that even the youngest readers need have no hesitation in entering the competition.

Entries in the present competition will be divided into the following Sections: (A) for competitors over 14 living in the British Isles, (B) for competitors under 14 living in the British Isles, and (C) for competitors of all ages living Overseas.

The prizes to be awarded in each Section are listed in the panel at the foot of this page.

Many readers spoil their chances of winning prizes in competitions of this kind by devoting almost the whole of their attention to the building of the model, and giving very little thought to the choice of the subject. Certain common types of model are submitted in considerable numbers in one contest after another, little attempt being made to vary the design. The result is that such hackneyed models must be quite remarkably well constructed if they are to have any chance of winning prizes. On the other hand, models that have something novel or original about them, even if they are not so well constructed, are likely to attract the favourable attention of the judges. Here again it must be emphasised that the size of a model has no effect on its prize-winning chances; indeed, it is often the case that a small but effectively-designed model succeeds where a big cumbersome structure fails.



It is not necessary to possess a large Outfit in order to win a prize in a Meccano Contest. This simple but interesting model was among the successful entries in a recent competition.

The best advice to competitors therefore is: "Choose as interesting a subject as possible for your model, and then build this as well as you can with the parts at your disposal, without worrying about other competitors who have more parts."

Competitors may be reminded that entries for this competition are not necessarily limited to machines and mechanical structures. Architectural subjects are equally eligible, and there is room also for well-designed models of a humorous or quaint nature.

Once again we remind competitors that the actual models must not be submitted. All that is required is a photograph, or if this cannot be secured, as good a drawing as possible. If a competitor feels that his photograph or drawing does not show clearly some important feature of his model he may add a few words of description. The competitor's age, name and address must be written on the back of each photograph or drawing, together with the letter A, B or C to indicate the Section for which the model is entered. The size of the Outfit used must also be stated.

Entries should be addressed "September" Model-Building Contest, Meccano Ltd., Binns Road, Liverpool 13. Those for Sections A and B must be posted to reach Liverpool not later than 31st October, 1935; and those for Section C not later than 31st December, 1935. Prizewinning entries become the property of Meccano Ltd. Unsuccessful entries will be returned if a stamped envelope is sent for that purpose.

"September" Model-Building Competition

The Prizes

The following prizes will be awarded in each of the Sections A and C.

First Prize: Meccano or Hornby Goods value £3-3s.
Second Prize: Meccano or Hornby Goods value £2-2s.
Third Prize: Meccano or Hornby Goods value £1-1s.
Five Prizes of Meccano or Hornby Goods value 10/6.
Five Prizes of Meccano or Hornby Goods value 5/–.

In Section B the prizes will be:

First Prize: Meccano or Hornby Goods value £2-2s.
Second Prize: Meccano or Hornby Goods value £1-1s.
Third Prize: Meccano or Hornby Goods value 10/6.
Ten Prizes of Meccano or Hornby Goods value 5/–.
Certificates of Merit.

Model-Building Competition Results

By Frank Hornby

"New Year" Contest (Home and Overseas)

The lists of prizewinners in the Home and Overseas Sections of the "New Year" Competition were as follows:

Section A (competitors over 14).

1ST, Meccano or Hornby Goods value £3–3s.: Lieut.-Commander A. Gray R.N., Devonport. 2ND, Goods value £2–2s.: P. Notman, New Malden. 3RD. Goods value £1–1s.: L. Kirk, Luton.

Goods value 10/6: L. Arter, Herne Bay; R. Benson, Manchester; F. Byron, Liverpool 13; A. Dobson, Nottingham; R. Furmedge, Basingstoke; J. Harley-Mason and D. Cashmore, Ruislip, Middlesex (joint entry); C. Malherbe, St. Heliers, Jersey; G. Sinclair, Canterbury.

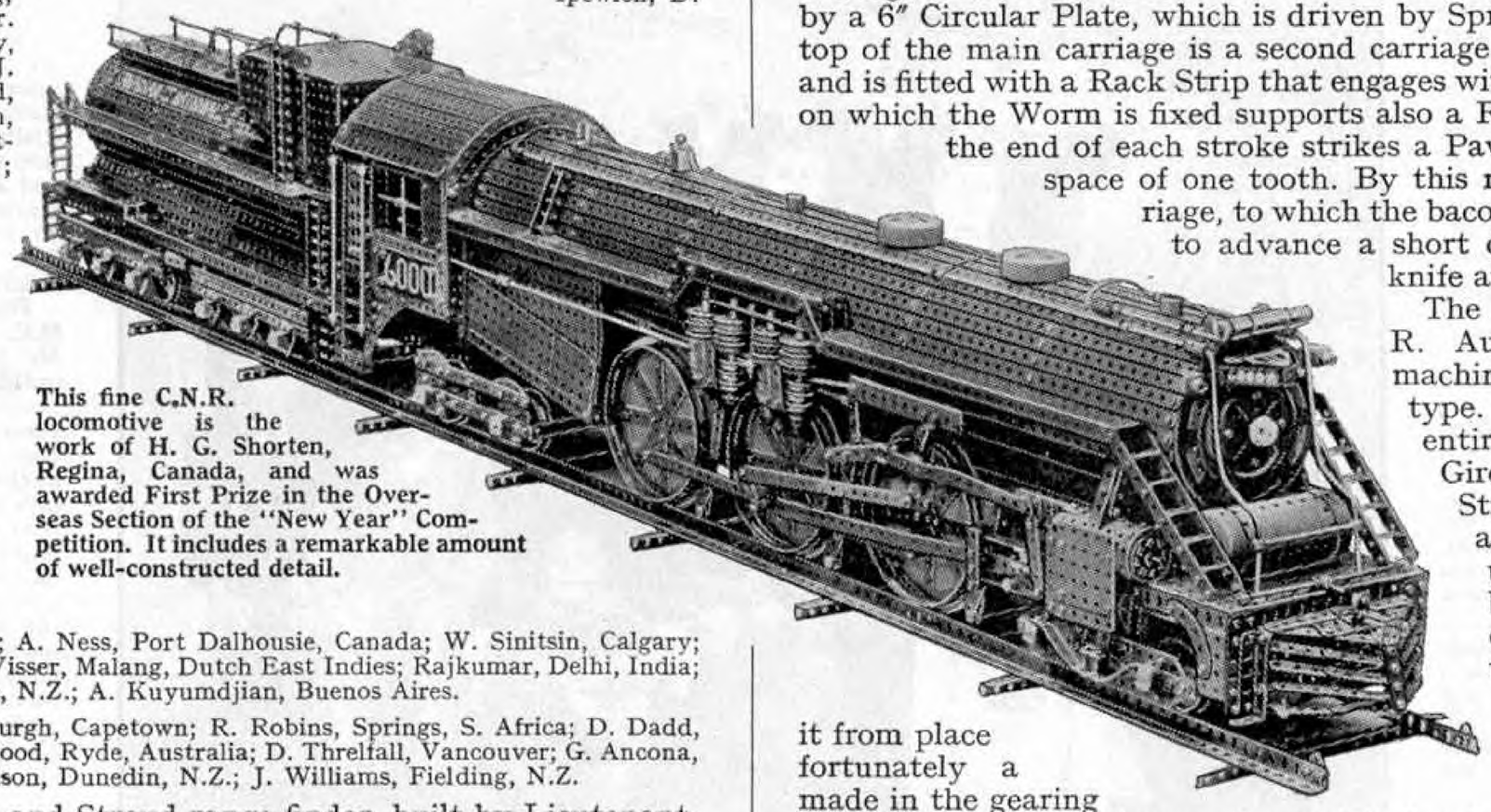
Goods value 5/–: R. Babb, Plymouth; A. Borthwick, Sanderstead, Surrey; N. Forrester, Newcastle; A. Girvin, Scarborough; P. Mead, Southend-on-Sea; A. Pollard, Manchester; A. Shaw, London, N.W.5; R. Walford, Newton Abbot.

Section B (competitors under 14).

1ST, Meccano or Hornby Goods value £2–2s.: E. Clements, Farnborough. 2ND, Goods value £1–1s.: N. Macleod, Leigh-on-Sea. 3RD, Goods value 10/6: R. Austin, Broadstairs.

Goods value 5/–: W. Cox, Luton; R. Edwards, Grantham; P. Fleming, Kildary; H. Guthrie, Buckhaven; W. Hawthorne, Wolverhampton; C. Holden, Ballymena, Co. Antrim; H. Morling, Ipswich; D. Whitebread, Rochester.

Goods value 2/6: S. Berry, Pill, Nr. Bristol; J. Elwood, Belfast; D. Head, Beckenham; C. Marsh, London, S.E.17; K. Matsuyama, London, W.11; R. Prince, Matlock; E. Richardson, Swanley Junction; N. Whittaker, Burton-on-Trent.



This fine C.N.R. locomotive is the work of H. G. Shorten, Regina, Canada, and was awarded First Prize in the Overseas Section of the "New Year" Competition. It includes a remarkable amount of well-constructed detail.

Section C (Overseas competitors).

1ST, Meccano or Hornby Goods value £3–3s.: H. Shorten, Regina, Canada. 2ND, Goods value £2–2s.: A. Argentino, Buenos Aires. 3RD, Goods value £1–1s.: M. Virtanen, Helsinki, Finland.

Goods value 10/6: A. Wade, Sydney, N.S.W.; A. Ness, Port Dalhousie, Canada; W. Sinitsin, Calgary; A. Yates, Toronto; W. Visser, Malang, Dutch East Indies; Rajkumar, Delhi, India; H. Mountfort, Ohakune, N.Z.; A. Kuyumdjian, Buenos Aires.

Goods value 5/–: R. Myburgh, Capetown; R. Robins, Springs, S. Africa; D. Dadd, Moss Vale, N.S.W.; I. Hood, Ryde, Australia; D. Threlfall, Vancouver; G. Ancona, Padova, Italy; R. Dickison, Dunedin, N.Z.; J. Williams, Fielding, N.Z.

A model of a Barr and Stroud range finder, built by Lieutenant-Commander A. Gray, R.N., Devonport, was awarded First Prize in Section A. Large guns have graduated scales on their elevating mechanism, which show the distance a shell will travel if fired at a given elevation. Before the shell is fired the range of the target is determined by means of a range finder, and the gun is then elevated to the angle necessary for the shell to travel that distance. The model range finder consists of a tube built up from Angle Girders and Strips, and having at one end a mirror fixed at 45 degrees to the axis of the tube, and at the other end a second mirror that can be rotated about one edge. In the centre of the tube, on the side opposite from the openings occupied by these mirrors, is another opening provided with two further mirrors, which are mounted vertically one above the other, and face in opposite directions. The edges of the centre mirrors are placed perpendicularly to each other and at 45 degrees to the axis of the tube. The movable mirror is rotated by means of a hand-wheel working through a Crank, a Threaded Boss and a Screwed Rod, and the hand-wheel also causes a pointer to move over a graduated dial, which indicates the range in feet.

The instrument is mounted on a pedestal so that it can be swivelled in any direction by means of a small hand-wheel, and is used as follows. The position of the tube is first adjusted by means of the hand-wheel until the target can be seen in one of the fixed mirrors. The movable mirror is then slowly rotated until a second image of the target observed in the other centre mirror is superimposed on the first image, when the range can be read off from the dial.

Second Prize was awarded to P. Notman, who submitted a model of H.M.S. *"Bulldog,"* the hull of which is made from Plates and Braced Girders. There is nothing particularly outstanding about the model but it is exceptionally neat in construction, and it was this feature that earned it a prize. Cord is used for the rigging, rails and wireless aerial, and small flags add a touch of realism to the foremast.

Third Prize was awarded to L. Kirk for a model locomotive based on an L.M.S.R. "Prince of Wales" class engine.

A gas cooker complete with rings, griller, plate racks, oven shelves and other fittings common to a modern cooker, is the most outstanding entry in Section B. Plates and Strips are used for the framework, and pieces of white cardboard for filling in the sides and door. The model incorporates several novel uses for Meccano parts and is strongly and neatly constructed. The model was built by E. Clements.

A model bacon slicing machine built by N. Macleod was awarded Second Prize in this Section and, although it is not based on any particular type of commercial machine, it performs all the essential operations of an actual slicer. The hand-wheel operates a vertical shaft, on the upper end of which is a Crank that draws the moving carriage backward and forward. The revolving knife is represented by a 6" Circular Plate, which is driven by Sprocket Chain. On the top of the main carriage is a second carriage that moves in slides and is fitted with a Rack Strip that engages with a Worm. The Rod on which the Worm is fixed supports also a Rachet Wheel that at the end of each stroke strikes a Pawl and is rotated the space of one tooth. By this means the upper carriage, to which the bacon is clamped, is made to advance a short distance towards the knife at the end of each cut.

The model submitted by R. Austin is a wringing machine of the old-fashioned type. The frame is made entirely from Strips, Angle Girders and Curved Strips, and Flat Plates and Flat Girders are used for the wringing boards. The model is complete with roller tension screws and wheels for moving it from place to place, but unfortunately a mistake has been made in the gearing of the rollers. The spindle on which the lower roller and its hand-wheel are mounted is fitted also with a 57-teeth Gear Wheel, and this engages with a ½" Pinion on the spindle of the upper roller. When the hand-wheel is turned, the upper roller rotates at three times the speed of the lower one, which of course is not correct. Apart from this, however, the model is well designed.

The graceful model Canadian National Railways locomotive shown on this page is the work of H. G. Shorten, and won First Prize in the Overseas Section of the Contest. The model is a fine example of model-building skill and is one of the best that I have had the pleasure of examining for some time. Mr. Shorten may justly be proud of his workmanship. The model is 6 ft. 6 in. in length and was displayed at a number of shops, where it attracted considerable attention.

A point in which I was particularly interested is the tremendous amount of care and thought that has gone into the construction of the fittings of the model.

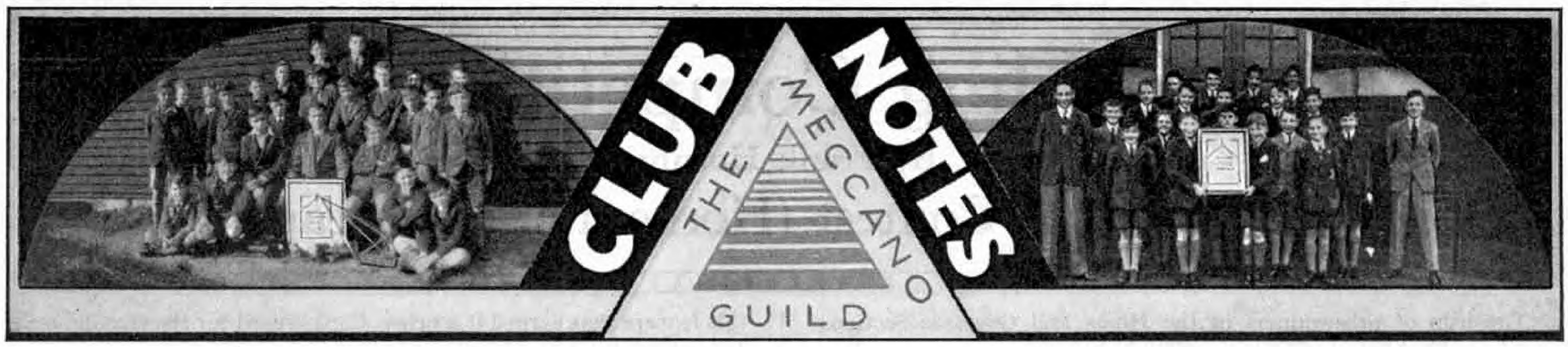
"Limited Parts" Contest

The results in the Overseas Section of the "Limited Parts" Competition, which was announced in the February, 1934 *"M.M.,"* are as follows:

1ST, Meccano or Hornby Goods value £2–2s.: P. Blight, Killora, N.S.W. 2ND, Goods value £1–1s.: W. Jackson, Gatooma, S. Rhodesia. 3RD, Goods value 10/6: T. Cheong, Kuala Lumpur, F.M.S.

Prizes of Goods value 5/–: E. Watkins, Alberton, S. Australia; G. Choquette, Calgary, Canada; F. Abbott, Wellington, N.Z.; M. Walbridge, Dargaville, N.Z.; D. von Kebeita, Beyrouth, Syria.

Prizes of Goods value 2/6: M. Lupton, Elgin, S. Africa; G. Rannie, Munson, Canada; E. Shalom, Basra, Iraq; E. Lloyd, Canterbury, N.Z.; J. Capelli, Buenos Aires.



Hutton Modern School (Eccleshill) M.C.—Bolton Abbey was visited on the first run of the newly formed Cycling Section, and this event was so successful that outings to York, Settle and Ripon were arranged. A Lantern Lecture on "*A Tour of Great Britain*" has been given. Meccano and Hornby Train Nights are held regularly and small prizes are awarded in the competitions held on Model-building Evenings. Club roll: 12. *Secretary:* W. Holdsworth, 44, Victoria Road, Eccleshill, Bradford.

Dagenham M.C.—A new club room has now been obtained and arrangements are being made for Model-Building Evenings, Games Evenings and other activities. Excellent models already have been brought to meetings for exhibition. Interesting talks have been given and a special effort is being made to increase membership. Club roll: 50. *Secretary:* J. Dobinson, 17, Freshwater Road, Dagenham, Essex.

Twenty-eight (Edinburgh) M.C.—Club meetings are almost entirely devoted to model-building, members choosing models and constructing them from the club Outfit. Talks are given at each meeting by Mr. J. M. Ferguson, Leader, or Mr. McCall Barbour, President. Lantern Lectures on "*Oban*" and "*The Land of Lorne*," and visits to Granton Gas Works also have been arranged, and an enjoyable time was spent on a ramble to the summit of Arthur's Seat. Club roll: 12. Leader: Mr. J. M. Ferguson, 7, Roseneath Terrace, Edinburgh.

St. Saviour's (Raynes Park) M.C.—The Exhibition held in conjunction with the associated Branch of the H.R.C. was widely advertised by means of posters, circulars, and the display of a lantern slide at the local picture house, with excellent results. Models of the Automatic Ship Coaler, Marine Engine and other Meccano models on loan from Headquarters attracted special attention, and great interest was taken in the three Hornby railway tracks, on which operations were carried out throughout the evening. The hall was decorated for the occasion and refreshments were supplied. Club roll: 10. *Secretary:* R. Woollcott, 33, Crossway, Grand Drive, Raynes Park, London, S.W.20.

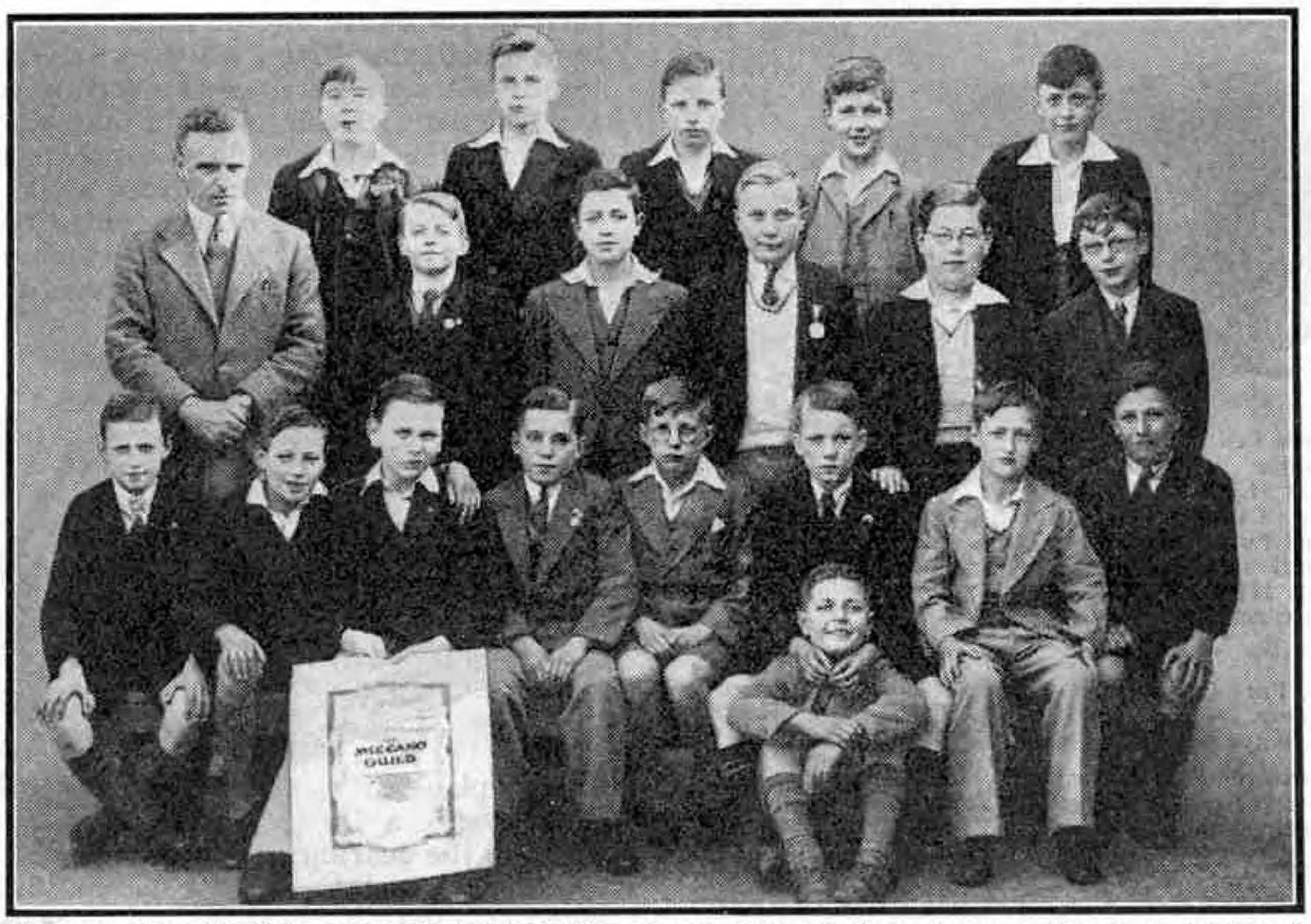
Newtownards M.C.—Excellent progress is being made and a special photograph of members has been taken for inclusion in the Guild pages of the "*M.M.*" During the summer most of the meetings took the form of outings, all of which proved very enjoyable. Indoor work is now recommencing and at present model-building is the chief activity. Club roll: 9. *Secretary:* J. Getty, Hillcrest, Newtownards.

Exeter M.C.—Model-building continues to be carried on extensively. A new scheme has been introduced on Contractors' Nights, those taking part being asked to estimate the number of parts required when putting in tenders for the work carried out. Great interest has been taken in summer visits from Meccano enthusiasts in other parts of the country who correspond regularly with Mr. Hodder, Leader. The Buckingham Palace model built by members has been sent on loan to Sidmouth for display by the Sidmouth M.C. Club roll: 22. *Secretary:* T. W. A. Smith, 98, Ladysmith Road, Exeter.

Regent Street Central School (Heywood) M.C.—Members of the club took a prominent part in the annual School Outing, which this year was held at Stratford-on-Avon. Lantern Lectures have been given on "*Heraldry*" by Mr. Whitworth, and on "*The Life of George V*," by Mr. G. N. Chaplin, Leader. An interesting talk also was given by Miss Gregory on a holiday in France. Club roll: 120. *Secretary:* T. Wild, 1, Orchard Street, Heywood, Lancs.

John Gulson Senior Boys' School (Coventry) M.C.—Model-building was carried on actively to the end of the summer session, members fighting hard for points in the Sessional Contest. The models constructed were displayed on the School's Open Day. They included a splendid workshop, and a further attraction was the Funicular Railway and Meccanograph on loan from Headquarters. In addition to the individual contest, there was keen competition between the two sections of the club in the contest for the Club Shield. A large Hornby train layout was included among the attractions on view at the School's Open Day. Club roll: 29. *Secretary:* T. Chappell, 8, Troughton Crescent, Radford, Coventry.

Wednesbury and District M.C.—A large model of the Eiffel Tower has been completed by a group of members and individual model-building also has been carried out. Indoor meetings have been varied by a Surprise Model-Building Contest, and Table Tennis. An interesting visit was paid to the R.A.F. Unit at Castle Bromwich, where parachutes and cameras were inspected and displays of flying watched. Two gliders also were seen and an air liner arrived and departed. Cricket and rambles and other outings provided the greater part of the summer programme. Club roll: 10. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.



Members of the South Parade Modern School (Cleckheaton) M.C. Mr. G. B. Inskip, Leader, is on the left of the second row, and K. Walker, secretary, is seated behind the club's Certificate. The club was affiliated in September, 1934, and recently organised a successful Exhibition, at which the central feature was a model coal mine linked with a power station by means of a Hornby Railway.

Gate House School (Ingatestone) M.C.—A miniature town is being built in association with the members of the Hornby Train Section, who are constructing a railway through the model. Meccano is being used in building gas works, and in constructing scaffolding and frameworks, and excellent progress is being made. *Secretary:* F. Melville, The Gate House School, Ingatestone, Essex.

Middlesbrough M.C.—The Swimming Section has made excellent progress, weekly meetings having been held regularly. The Cycling Section also is very active and an enjoyable outing to Saltburn has been arranged. Indoor meetings have been chiefly devoted to games, Table Tennis being the favourite, but a Debate on the relative merits of football and cricket also has been held. Club roll: 18. *Secretary:* L. Shepherd, 29, High Street, North Ormesby, Middlesbrough.

Hornsey M.C.—A Lecture on "*Tobacco*" was given twice by Mr. R. Shooter, Leader, and other indoor meetings have been devoted to Model-building, Table Tennis and Mah Jong. The Annual Meeting revealed a flourishing state of affairs, the balance in hand being more than £2. Excellent games of cricket are enjoyed several times a week by members of all sections, and talks on science and other subjects are given by the Leader at meetings held in his garden. Club roll: 39. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

Sutton Valence Council School M.C.—The chief event of the summer programme was a Sports Contest in which members of the club opposed the rest of the School, each team being divided into groups according to age. Events included a slow cycle race, a high jump, a standing broad jump and cricket ball throwing in addition to races over various distances. The club team beat the rest of the School by 96½ points, and the Silver Medal for the best individual competitor was won by a member of the School team. In model-building finishing touches were put to the electrical model prepared for exhibition at a Summer School for teachers at Southampton. Keen interest was taken throughout the school in this attractive meeting. Club roll: 18. *Secretary:* B. Hills-Johnes, "The Spinney," Kingswood, Ulcombe, nr. Maidstone.

AUSTRALIA

Sydney M.C.—The annual meeting attracted an attendance of more than 200 and the report showed assets of £12, with a balance of more than £6. At other meetings Meccano parts have been renovated, and experiments have been carried out, in co-operation with members of the associated H.R.C. Branch, on automatic signalling methods. Model-builders are very active, and an interesting clock has been constructed by Mr. A. Wade. Visits have included an inspection of Bunnerong Power House and a ramble down the Darling Harbour goods line. Club roll: 10. *Secretary:* W. J. T. Watson, 595, Parramatta Road, West Leichhardt, N.S.W.

Thebarton Junior School M.C.—At a special meeting Mr. E. S. H. Gibson, Leader, outlined the club's activities. Several excellent Lantern Lectures have been given by members, and a Master who served in the Great War gave a useful talk on "*The Cruelties of War.*" A model for measuring the time required to respond to impulses has been constructed, and special interest has been taken in the construction of a Meccano model of the world's largest lorry. Club roll: 80. *Secretary:* M. Campbell, Thebarton Junior Technical School, Ashley Street, Thebarton.

ITALY

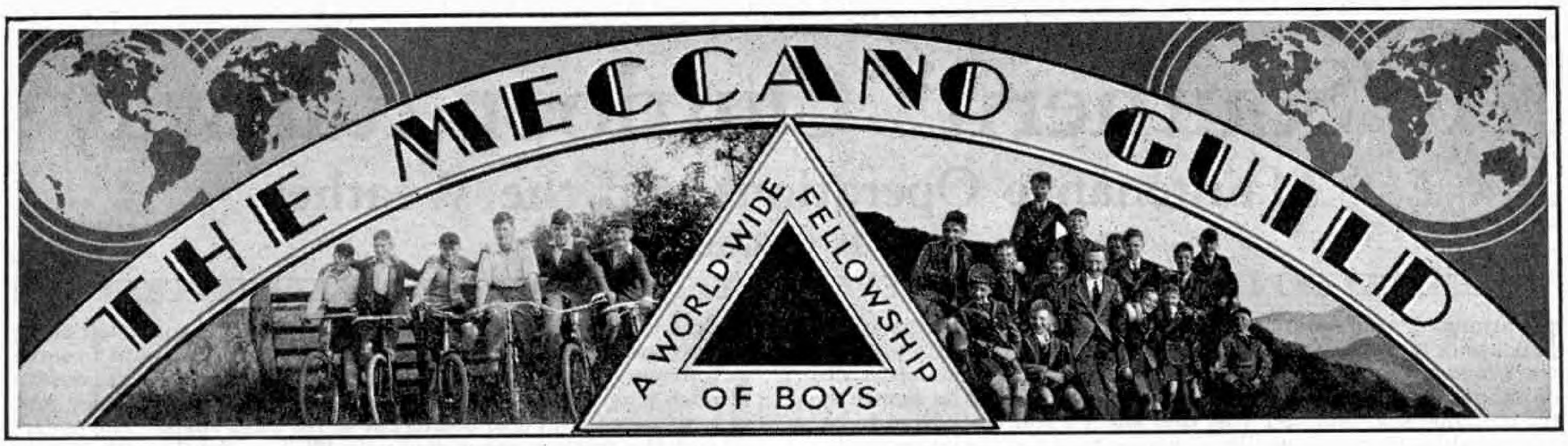
Milan M.C.—Recent meetings have been devoted chiefly to visits. Special interest was taken in the engineering and radio exhibits at the International Samples Fair, and in the display of cinematograph projection apparatus, for the club itself possesses a projector. Football Matches also have been played and members visited a special Sports Display. Club roll: 14. *Secretary:* C. Vigo, Corso Genova 19, Milan, Italy.

JAMAICA

Munro College M.C.—Models built by members were displayed in the school after the Annual Sports, and greatly interested parents of members. A similar display was made on the occasion of a visit of a party of English public school boys. The models shown included a Gantry Crane and a Stiff-Legged Derrick, together with a Motor Car and other models entered in the club's Model-Building Cup Competition. A turntable, fencing and scenery has been added to the Hornby Train layout. Bookbinding, Fretwork and Electricity are other activities that have been taken up, and one member has constructed a wireless receiver. The Football Club won a praiseworthy victory by four goals to nil over a club from a neighbouring school. Club roll: 20. *Secretary:* H. G. Maxwell, Munro College, Munro P.O., Jamaica, B.W.I.

SPAIN

Marsa (Tarragona) M.C.—A special Exhibition has been held in one of the college departments. The chief feature was a Hornby Train layout, and explanations were given of the working of the locomotives and of the use of accessories. There was a large attendance of interested visitors, and a medal was presented to Mr. J. A. Costa, President, in recognition of his good work. Club roll: 7. *Secretary:* J. A. Costa, Plaza de la Libertad No. 1, Marsa, Spain.



Preparations for a Record Session

This month club nights again will become the chief events of the week to keen Meccano boys, who will return to model-building, and the many hobbies and pursuits that make up the usual indoor programme, with renewed zest after their holidays and the delights of the outdoor season. I have already received advance copies of the programmes arranged in many clubs. In other cases Leaders have made the necessary preparations for submitting their schemes to members at the special business meeting that will open the Session, a wise plan that gives those taking part in club work ample opportunity of suggesting further attractions. The indications point to new records in club activity and I want every Guild and club member to make up his mind to do what he can to ensure this.

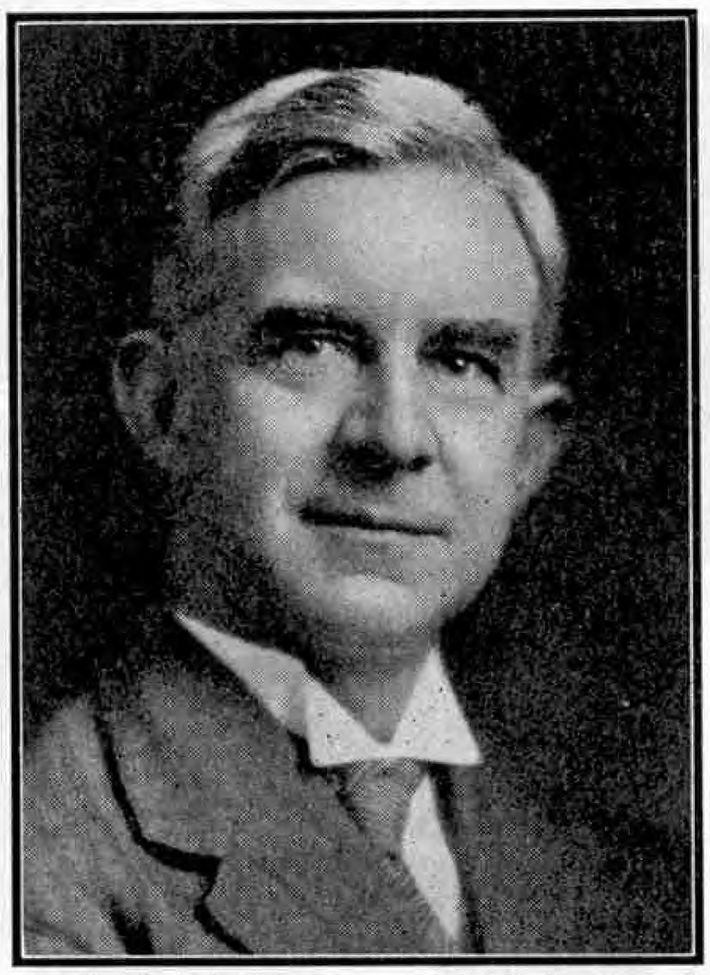
Recruits Wanted

The beginning of the first Winter Session is one of the best times of the year for efforts to strengthen a club, for then many boys interested in Meccano or Hornby Trains are looking for congenial occupations for the dark evenings. I am more than ever convinced that a Meccano club cannot be really successful unless recruiting brings in young and eager members who eventually will take part in controlling the club, perhaps in succession to older members who are compelled to leave because of removals or for other reasons. Personal efforts are most effective with recruits of this kind, and it should be the aim of every member to introduce at least one of his friends to club life. It is a good plan to set aside an evening on which to give a special welcome to recruits brought in in this manner. This should coincide with the first business meeting, which could be made social in character to celebrate the resumption of the familiar indoor work, and the proceedings then will help to show recruits what happy times they can enjoy if they live up to the spirit of the Guild and the Meccano club movement. A meeting of this kind will enable new members to settle down at once.

Recruiting for the Meccano Guild also should be kept in mind. Although it is not compulsory for club members to belong to the Guild, it is advisable for them to join, and supplies of Guild leaflets containing application forms should be in the possession of all members and should be available at all club meetings. I shall be very pleased to forward copies to Leaders or secretaries of clubs, and also to all Guild members who make application for them. Those who distribute leaflets among their friends should take care to write their names at the head of the application forms to enable me to keep track of their recruits. Every member who secures three recruits in three months is awarded a handsome Recruiting Medallion, and I will have this engraved with his name and the words "Special Award" if he secures three further recruits, making six in all, in the following three months. Every member who has not already earned the Recruiting Medallion should start a little recruiting campaign of his own immediately.

Meccano Club Leaders

No. 82. Dr. A. G. Butchers, M.A.



Dr. A. G. Butchers, M.A., has been Leader and organiser of the Correspondence School (Wellington) M.C. since its affiliation in September, 1932. Members of this club never meet, for they live in remote districts in New Zealand, but enter keenly into Model-building Contests arranged by correspondence. A "Meccano Magazine" circle also has been organised.

Merit Medallions

I should like Leaders to let me have their nominations for Merit Medallions for the Summer Sessions as soon as possible. May I remind them that in every affiliated club, at home or overseas, two Medallions are available each session for any kind of good service that has been to the benefit of the club, or of the Guild movement generally. The recommendation of the Leader is all that is necessary, and the names of those to whom the award is made are inscribed on their Medallions, and also included in a special list published annually on this page.

Leaders should bear this award in mind during the coming Winter Session, for it offers a suitable means of rewarding keenness in every branch of club work. Those who earn a Merit Medallion value it highly because it comes from the Headquarters of the Guild and is awarded with the knowledge and approval of Mr. Frank Hornby, President. I should like to see a record number of Medallions earned this year, and in view of the continual expansion of the club movement there should be no difficulty in achieving this end.

Membership Cards and Report Forms

Secretaries who have not already overhauled their stocks of club literature should do so immediately, and I shall be glad to forward membership and subscription cards to all who are in need of them. Report forms also are necessary, but this year I am sending supplies directly to all affiliated clubs, and any secretary who does not receive his copies during the next few days should write to me immediately.

I have often written about the great advantages that follow the submission of regular reports, but again must emphasise that I cannot give satisfaction to club members by including good accounts of their work in the "Club Notes" page unless I receive sufficient information from secretaries. A further point is that when reading reports I am often able to suggest means for improving the position of a club, but this is impossible when I am only given occasional information of a scrappy nature.

* * * *

The Sid Vale M.C. holds its Annual Exhibition in the Congregational Schoolroom, Sidmouth, on 10th, 11th, 12th and 13th September. On each evening the display will be open from 5.30 p.m. No charge will be made for admission, but a collection will be taken at the door.

Proposed Clubs

CARDIFF—J. G. Elmer, 8, Northcote Street, Roath.
FOXFORD—P. Cullen, Main Street, Foxford, Co. Mayo.
INDIA—S. Jhunjhunwala, 92, Harrison Road, Calcutta.
NEW ZEALAND—K. Wade, 101, Whittaker Street, Gisborne.
SAXMUNDHAM—W. Mayhew, Sandpit Cottage, Snape.
SIDCUP—A. R. Emery, 69, Willersley Avenue, Sidcup.
SWEDEN—I. Ekman, St. Sigfrids Skola, Räppe.

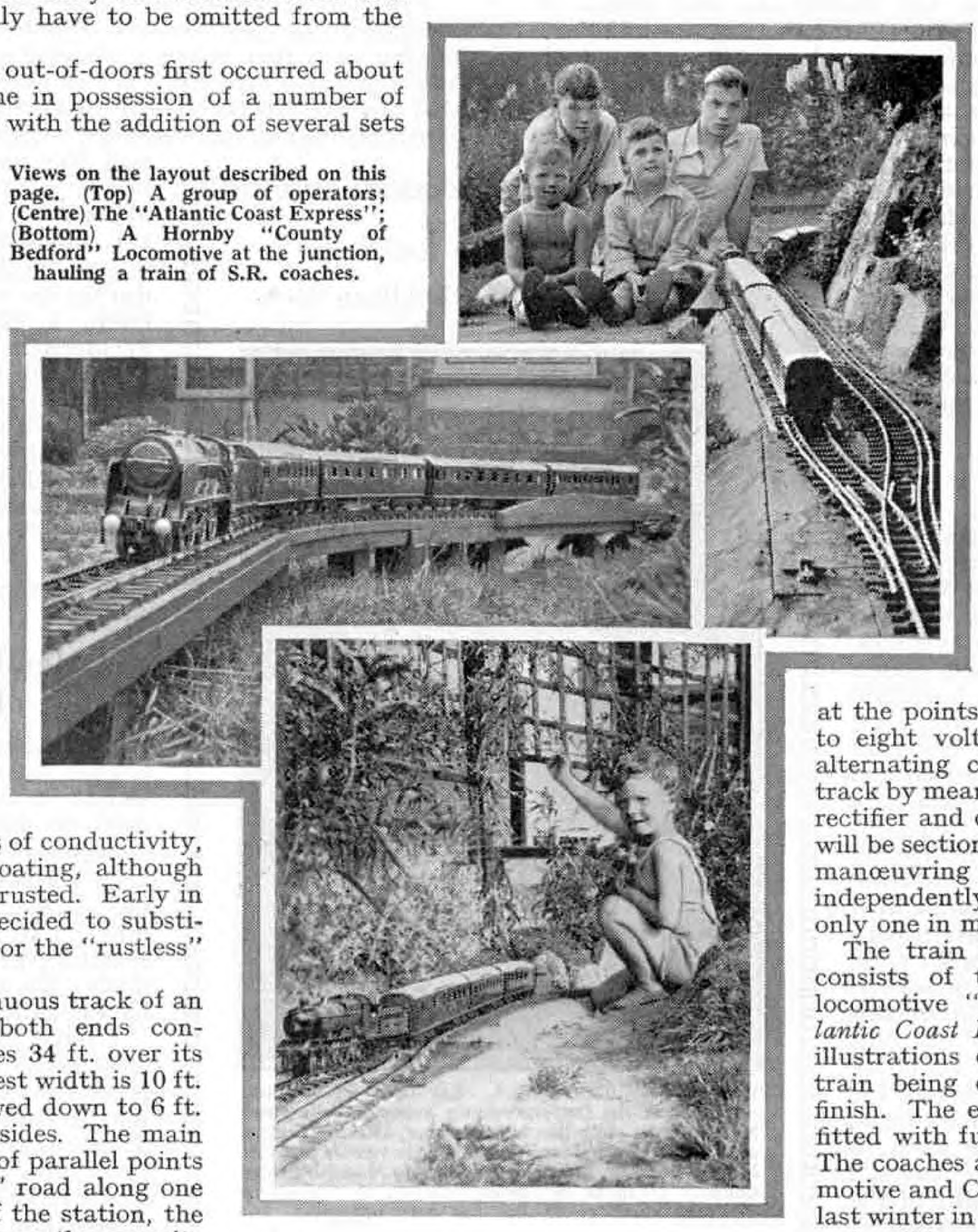
A "Southern" Outdoor Railway

Maintenance Operations and the Weather

By H. C. Raindle

IN arranging a miniature railway permanently out-of-doors every allowance must be made for the effects of the weather, and suitable track material and equipment are most necessary. The maintenance of an outdoor track is a continual struggle against the elements, for the same sun, rain and frost that affect a real track have to be withstood by the much smaller components of the miniature track, so that these effects must be allowed for and dealt with by the "Engineer." Thus the whole structure of the line has to be of a particularly robust nature, and many of the refinements that are possible indoors necessarily have to be omitted from the outdoor line.

The idea of putting a track out-of-doors first occurred about three years ago, when I came in possession of a number of lengths of keyed track. This, with the addition of several sets of points, made a sort of "figure eight" layout giving a run some 60 ft. in length. The rail, being of various sections, soon proved a source of trouble, and the whole of it was replaced early last year with rustless steel material. The layout was altered and improved at the same time, and a centre rail for electric traction was added. Complications ensued owing to the difficulty of inducing the current to pass through the steel fishplates, for these quickly rusted; but this was obviated to some extent by bonding the rails at the joints. Unfortunately, through the winter the rustless rail disgraced itself, and assumed a lovely russet tint! This was due mainly to the continual cleaning of the upper surface for purposes of conductivity, thus removing the rustless coating, although in many cases the whole rail rusted. Early in the spring therefore it was decided to substitute brass rail and fishplates for the "rustless" kind, with beneficial results.



Views on the layout described on this page. (Top) A group of operators; (Centre) The "Atlantic Coast Express"; (Bottom) A Hornby "County of Bedford" Locomotive at the junction, hauling a train of S.R. coaches.

The line consists of a continuous track of an irregular oval shape with both ends continuously curved. It measures 34 ft. over its greatest length, and the greatest width is 10 ft. 6 in., but this width is narrowed down to 6 ft. about the centre of the long sides. The main track is single, but by means of parallel points divides to form a "dead-end" road along one side of the island platform of the station, the main continuous track passing on the opposite side of the platform. For shunting and running-round purposes a loop line is being constructed alongside this "dead-end" line. The station, which is situated near one end of the layout, consists of a concrete platform with wood edging, and is 7 ft. 6 in. long and 9 in. wide. At the moment this is devoid of any buildings. A continuous run of some 83 ft. is afforded, with only one junction—the parallel points referred to—for the trains to negotiate.

The line includes some simple bridges and a tunnel. The latter has been temporarily removed for track alterations, but is being rebuilt in a new position. The bore will be of wood covered with roofing felt, and the whole will be completely covered with earth. The wooden tunnel mouths will be separate fixtures.

Generally the line is from 3 in. to 15 in. above ground level, being carried on 2 in. by 2 in. vertical stumps well sunk into the ground at about 18-in. intervals. The straight portions of the track are laid on deal boards $\frac{3}{4}$ in. thick and 4 in. wide, well screwed to 4 in. by 1 in. rough "garden edging." The latter is first well secured to the stumps with $2\frac{1}{2}$-in. nails, a piece of roofing felt being inserted between the top of the stumps and the baseboard to serve as a damp course. On the curved portions the baseboard consists of pitch pine 1 in. thick. This is first cut to the correct curve, and is surmounted with deal boards cut to the same shape. The underside of the track is being gradually filled in tightly with stones, an embankment then being formed in cement concrete.

A portion of the permanent way is ballasted with suitably small chicken grit. This is first placed in a jar of convenient size and soaked in water; and is then "shovelled" on to the track with the aid of a small spoon. Once in position, and packed fairly tightly, the ballast is sprayed with a mixture consisting of equal parts of turpentine and an outdoor varnish, by means of a small syringe. This is a fairly tedious job that is justified only by the greatly enhanced appearance of the track. As "King Sol" does his best to withdraw the track out "by the roots," $\frac{3}{4}$ in. long gimp pins are used for fixing the chairs to the sleepers; and for the same reason one cannot be too lavish with screws for fixing the two baseboards.

The conductor rail is now laid at the side of the track, with considerable advantage at the points. Direct current is used at six to eight volts, and is conveyed from the alternating current lighting mains to the track by means of a home-made transformer-rectifier and controller. The complete track will be sectionalised in order to permit of the manœuvring of three of four locomotives independently of one another, though with only one in motion at one time.

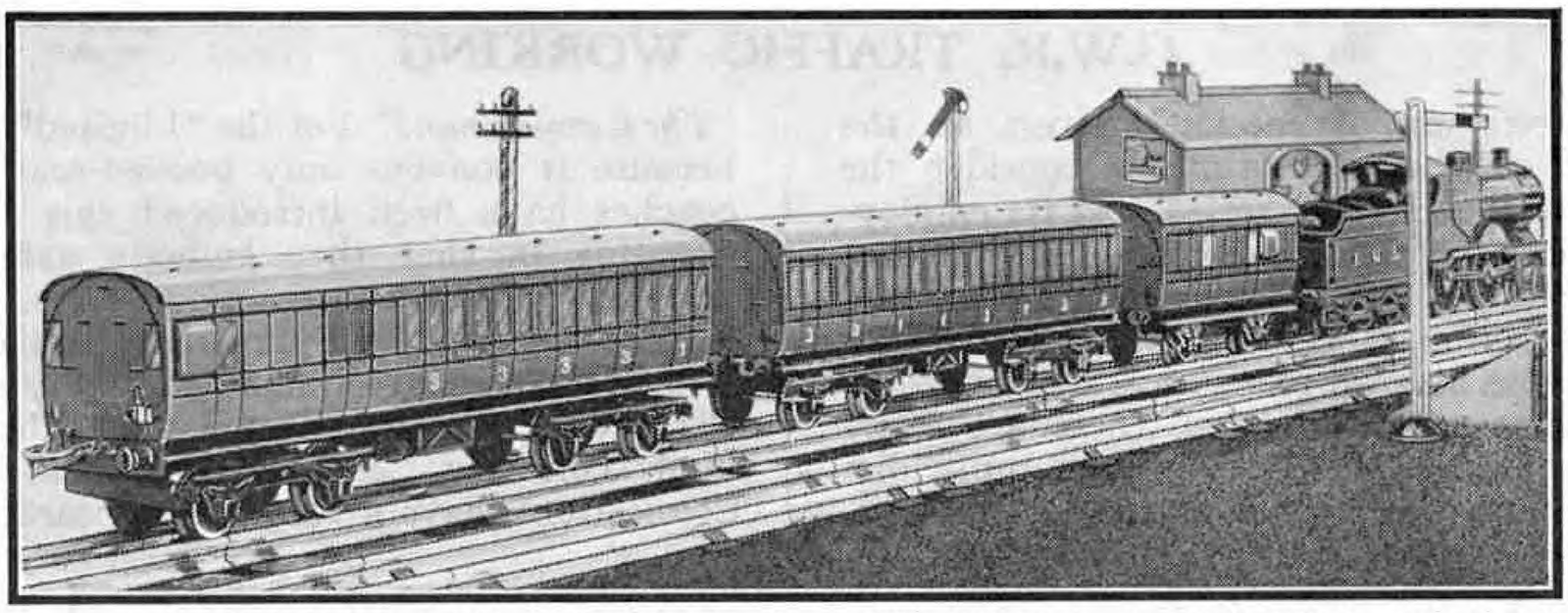
The train that is the pride of the line consists of the Southern Railway 4–6–0 locomotive *"Lord Hawke,"* with the *"Atlantic Coast Express"* shown in one of the illustrations on this page, the engine and train being of my own construction and finish. The engine is made of brass and is fitted with full outside Walschærts motion. The coaches also are products of our "Locomotive and Carriage Works," and were built last winter in whitewood, with glass windows and solid moulded roofs. They are hand painted and lined in accordance with Southern Railway practice. They are furnished internally with upholstered seats and dining tables, and the external fittings include door and commode handles, corridor connections and steps. There are ventilators on the roofs, and destination boards also are fitted, giving just the right touch to the complete train.

The "Company" operate also other stock of their own construction and some built by "outside contractors." The most important of the latter material is a Hornby clockwork 4–4–0 *"County of Bedford,"* a fine and useful engine. In addition, stock from other "Companies" in the district, consisting chiefly of Hornby locomotives and vehicles, frequently "works through." Several "foreign" lines even seem to have acquired almost unrestricted running powers over the railway here described. The friendly inter-working arrangements that exist between the Companies of actual practice are thus reproduced on this miniature system, especially at holiday times when the "through" traffic is particularly heavy.

New Bogie Coaches for Hornby Railways

By "Tommy Dodd"

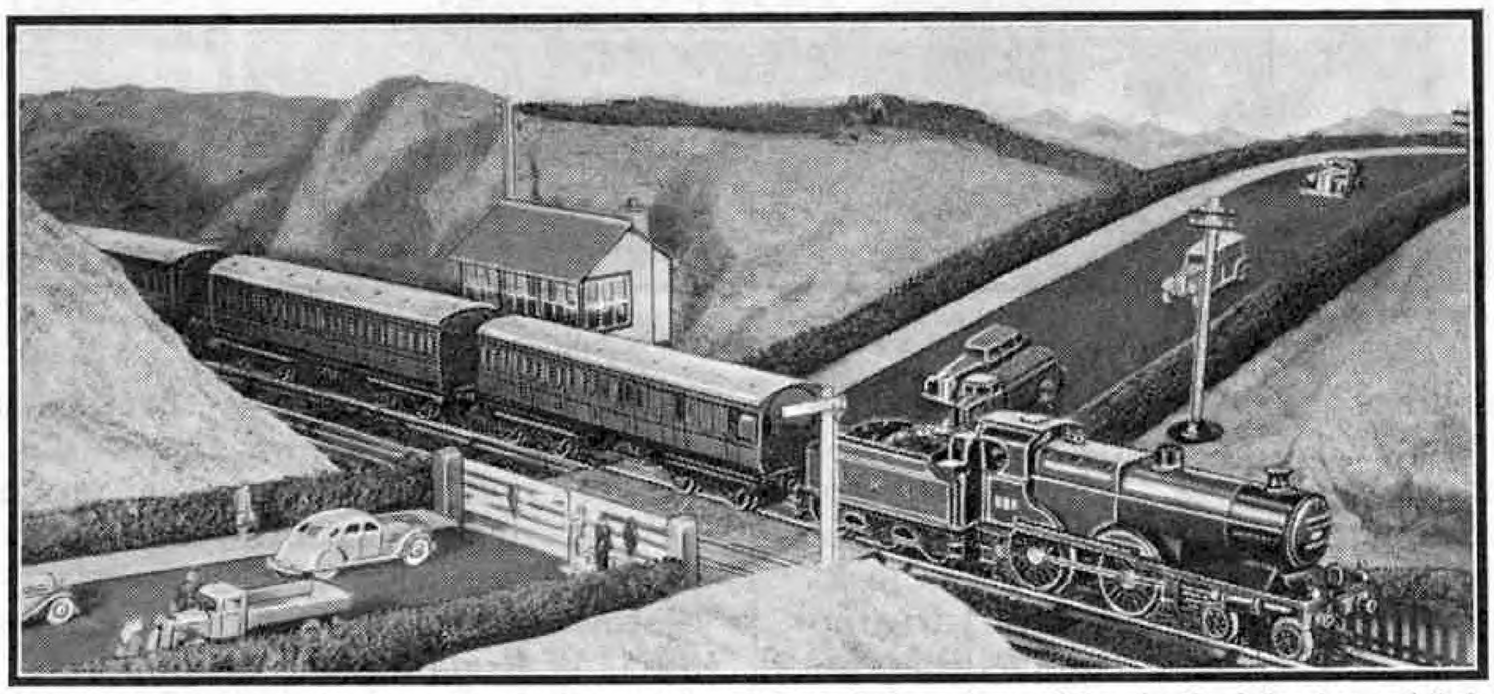
THE introduction of new Hornby Rolling Stock is always an event of importance, and this month I have the pleasure of drawing attention to the arrival of two No. 2 Compartment-type bogie Coaches finished in the colours of each of the four groups. One of these Coaches is a First-Third passenger vehicle; the other is a corresponding Brake - Third. Their general design and finish is perfect and a train made up of them has an appearance of quite remarkable realism with all the characteristics of the real thing that are so well known to us.



A rear-end view of a train of the new Hornby No. 2 Coaches. These vehicles incorporate a great deal of detail, even to the tail lamp shown on the Brake-Third.

The First-Third Coaches represent eight compartments, four in the centre for first-class travellers, and the others at each end for third-class passengers. The Brake-Third Coach represents five third-class compartments with guard's and luggage accommodation. Near the end are fitted the guard's lookouts, or side "wings."

The ends of the vehicles are finished to show the familiar boarded construction, and have represented on them the usual steps and handrails that give access to the roof. The luggage end of the Brake-Third vehicle has also two end windows. In addition the ends of each Coach are provided with two lamp brackets and suitable tail lamps. The lamps for use on the L.M.S.R. Coaches are aluminium in colour with dark red bulls, thus following the latest practice on this line. Those for the other railways are finished in the usual "danger" red, also with dark red bulls. These tail lamps look most effective.



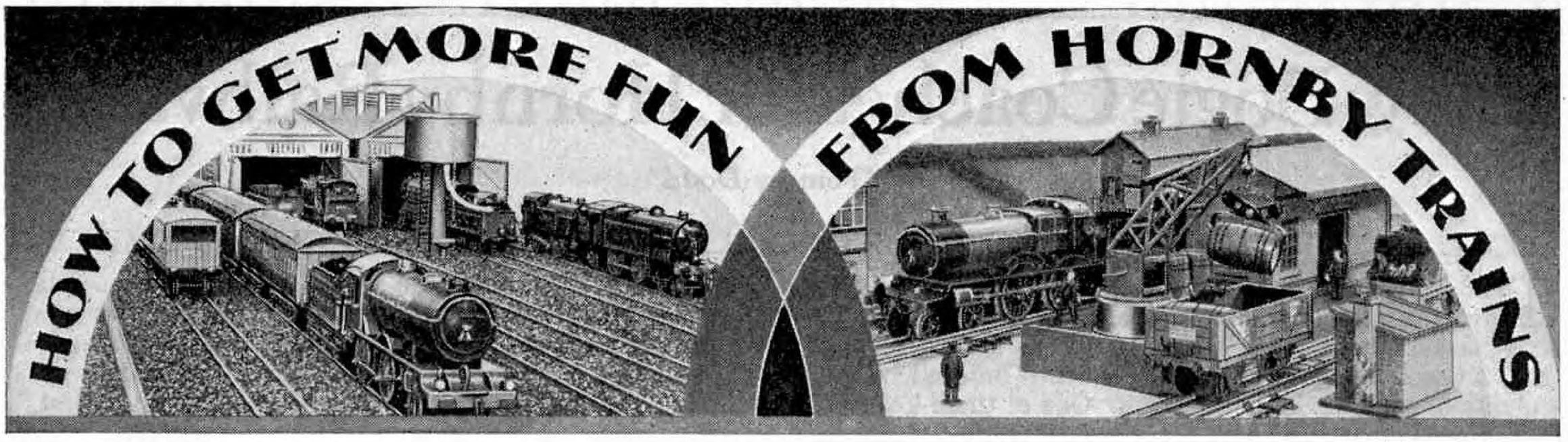
A fast train passing the level crossing of a busy roadway. The train is made up of Hornby No. 2 Coaches and their realistic and effective appearance is very striking.

The Coaches are coloured in the correct style for each of the four groups and are appropriately lettered and numbered. The tinprinted finish of the sides and ends allows of the reproduction of a great amount of detail. The characteristic panelling, and lining too, is fully carried out, except on the G.W.R. vehicles, for the latest practice of this company is to eliminate lining other than that along the waist of the coaches. Door handles and commode or "grab" handles are represented. The L.M.S.R. and L.N.E.R. vehicles have the figures "1" or "3" on the coach doors; the S.R. have the words "First" and "Third," and the G.W.R. only "First," without any indication on the third-class compartments. An interesting detail, representing the most up-to-date practice, is the incorporation of the G.W.R. monogram in the centre of the lower panels of each of the Coaches representing this line where it looks very smart.

The roofs fit closely, and are specially designed to eliminate the ugly "gutter" effect found on the roofs of most tinplate coaches. Above each compartment the roofs are embossed to imitate ventilators. In each case they are finished in grey, as this colour represents the average condition of a coach roof in actual service, and agrees with the practice already followed for Hornby No. 2 Special Pullman Coaches, and for the No. 1 Coaches.

The underframe details include a dummy accumulator box as fitted to modern electrically-lit stock, and at the lower edge of the solebars of each Coach a continuous footboard is formed. Standard buffers and Hornby automatic couplings are provided, the alignment of the latter being controlled from the bogies themselves, in order to ensure the correct engagement of the couplings on curves. The bogies are of the compensating type with Mansell wheels.

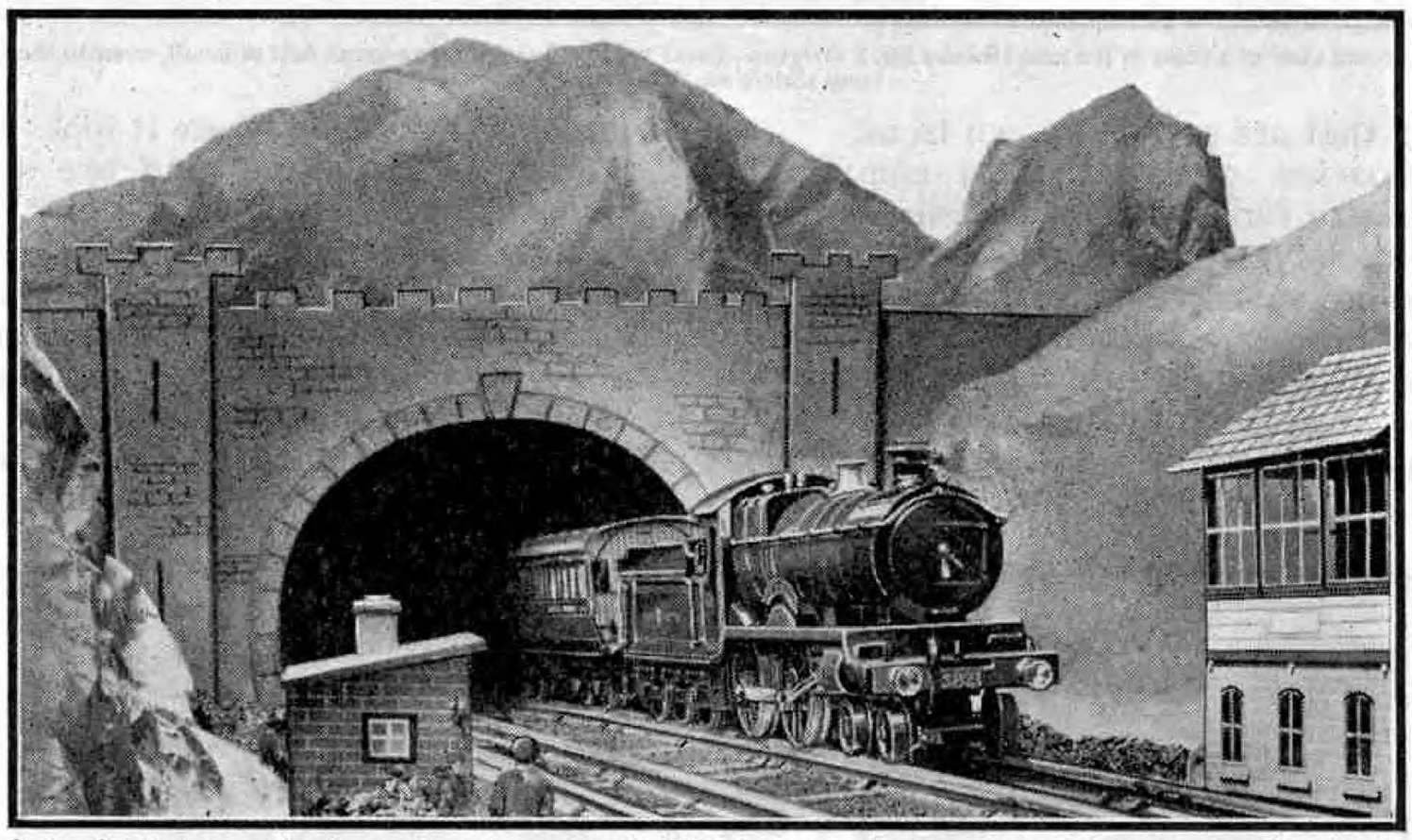
One First-Third Coach and one Brake-Third Coach are included in each of the new E220 Electric Special Tank Passenger Train Sets and the corresponding No. 2 Clockwork Special Tank Passenger Sets. The components of these Sets form ideal units for suburban passenger duties, longer-distance "residential" services, and even main line "semi-fast" traffic. The new Coaches are of course available also for separate sale.



G.W.R. TRAFFIC WORKING

AS G.W.R. matters are of special interest at the present time, it will be appropriate to consider the G.W.R. material of the Hornby Series, and its employment in such a manner as to reproduce the features that are characteristic of the operations of that company. Apart from the question of layouts, in which the individual owner follows his own preference, subject to the space and equipment at his disposal, there are many phases of G.W.R. traffic working that are quite distinctive and worthy of reproduction in miniature.

The fastest train in this country, the famous *"Cheltenham Flyer,"* regularly operated over Great Western metals, is run in miniature over many layouts that are based on this system. For the make up of such a train on a Hornby layout the new No. 2 Coaches are ideal, and they would be appropriately hauled by an E320, E36, or the corresponding 3C *"Caerphilly Castle"* Locomotive. "Castle" class engines are invariably employed on this duty in actual practice. On an electrically-operated layout the high sustained speed, yet perfect control of the train, and the energetic acceleration and smart, yet smooth, stopping can be reproduced perfectly. Clockwork engines also are quite suitable for rapid start-to-stop runs of this kind, although they lack the facilities for control afforded by the electric type.



A stopping train emerging from a tunnel on a Hornby G.W.R. layout. The tunnel mouth is made of cardboard and the effective "rocks" behind it are of brown paper, realistically crumpled and moulded.

Equally famous, although perhaps not so spectacular on paper, are the West of England trains that habitually convey heavy loads over long distances at high rates of speed. Here again for this type of working an electrically operated locomotive scores for long non-stop runs, and presents no difficulty on an electric continuous layout. The best known of these West of England expresses is undoubtedly the *"Cornish Riviera Express"* which for the summer season of this year has been divided into two trains, one being called the *"Cornish Riviera Limited,"* a reversion to its original name, and the other *"The Cornishman."* For the "Limited" service—so called because it conveys only booked-seat passengers—new coaches have been introduced this year that are interesting in that they embody exclusively the end-vestibule form of construction. Thus their reproduction by means of Hornby Pullman stock is an obvious suggestion, the colouring of this being very similar to that of the G.W.R. coaches. Complete vestibuled trains of this kind, correctly "gangwayed" with Hornby Corridor Connections, have a very fine appearance, as distinctive in miniature as the "Limited" is in actual practice.

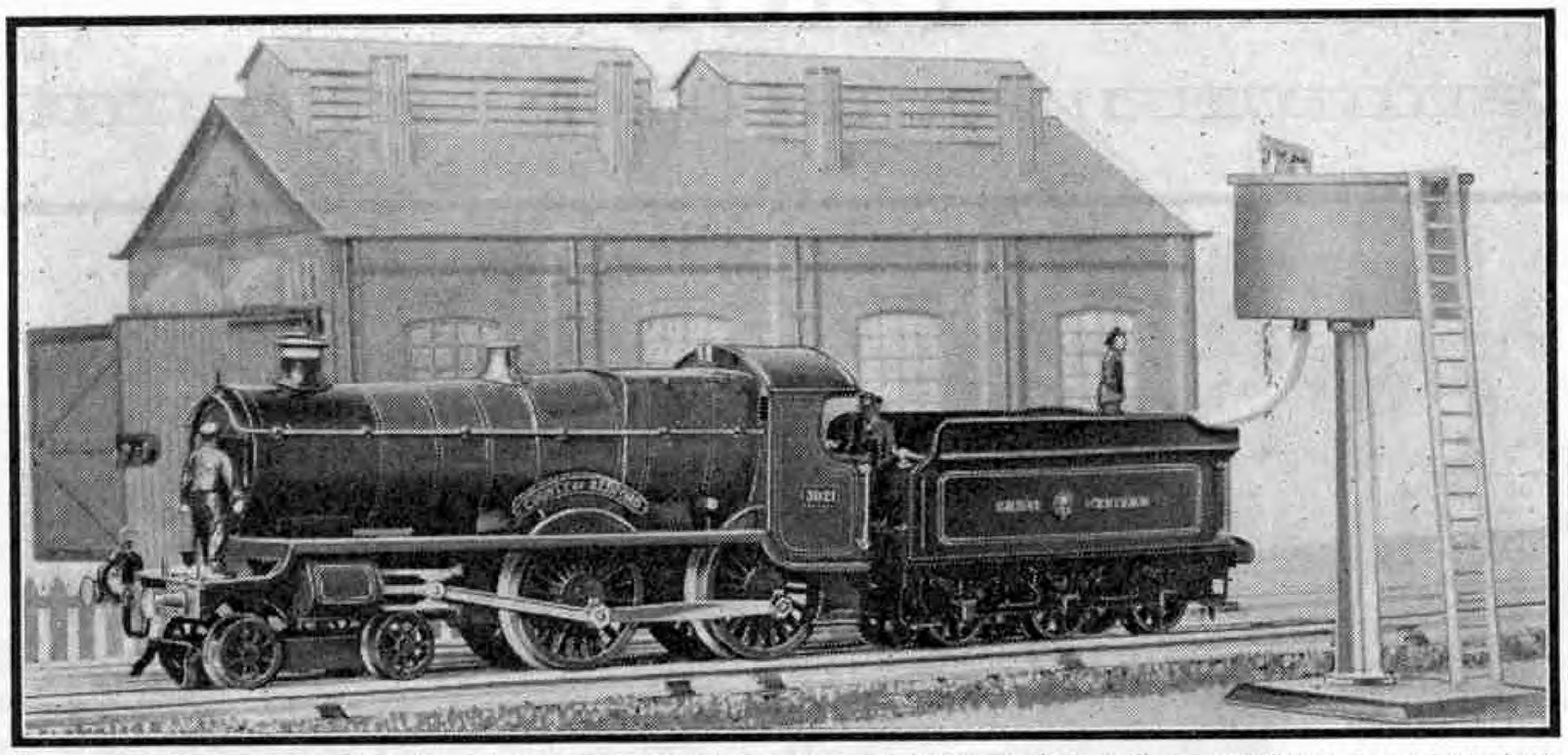
The South Wales and Cambrian Coast services, and those to Birmingham and the North, should not be forgotten, although it is unlikely that a G.W.R. enthusiast will have so extensive a layout as to permit of the running of all of these trains over the appropriate routes. The usual course is for the model railway "manager" to select a route or section that specially appeals to him and to concentrate on the working of the particular services found there in actual practice.

While dealing with the express trains we must not fail to draw attention to the singularly appropriate names bestowed on the chief G.W.R. expresses. To supplement the G.W.R. names and destinations that are found on the Train Nameboards of the Hornby Series, the reader will not find it difficult to letter appropriately strips of white card cut to a suitable length and width. *"Channel Islands Boat Express"* and *"Cambrian Coast Express,"* not to mention *"Cheltenham Spa Express"* are all fine-sounding titles that will give any miniature train carrying them a special air of interest.

As regards locomotives for these heavy duties, in addition to the *"Caerphilly Castle"* there is also the popular Hornby true-to-type *"County of Bedford"* that incorporates features typical of Swindon design. Correct G.W.R. practice is represented as far as possible in all

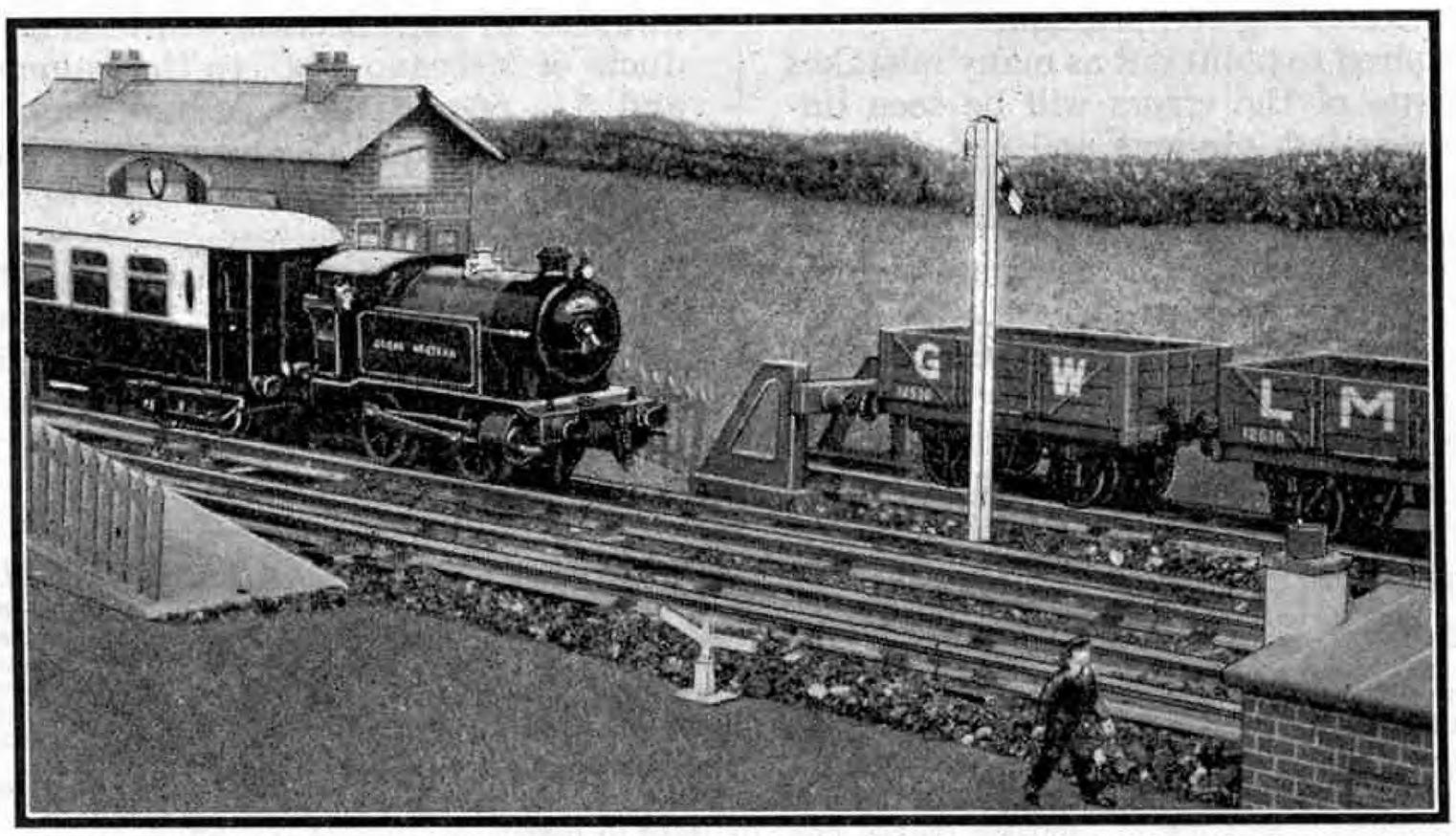
Hornby engines in their style and finish, the majority having outside cylinders and raised footplates, and all having domeless boilers. A stud of such Hornby locomotives is therefore as characteristic as the assembly to be seen at any G.W.R. locomotive depot.

For the shorter-distance traffic, such as that between Paddington and Windsor or Reading and similar services, the new No. 2 Coaches are particularly appropriate, although on smaller layouts the corresponding No. 1 vehicles can be adopted equally well. For such trains the E220, E26 or Clockwork No. 2 Special Tank are specially suitable types of engine, perhaps with the four-wheeled but very capable E120 Special or No. 1 Special Tank working in turn with them. A feature of G.W.R. local services is the extensive use of "push and pull," or motor, trains composed of one or more coaches with a small tank locomotive attached. In one direction the locomotive runs as usual, chimney first; but to obviate running round at terminal points the end coach is fitted with special driving arrangements by which the engine can be controlled. Thus the engine pushes its train in one direction, the driver then riding in the special driving compartment, while the fireman remains on the footplate. Special engines have been put into service by the G.W.R. for this kind of work to reproduce the older ones hitherto employed.



The popular Hornby "County of Bedford" Locomotive being prepared for duty. This engine embodies features typical of G.W.R. practice, as do the Engine Shed and Water Tank shown in the illustration.

This "push and pull" working can be reproduced in miniature, but it is only advisable with a relatively heavy bogie coach or coaches. For this work the No. 2 Pullman can be employed, as it resembles the somewhat special vehicles sometimes used for this purpose. Alternatively one of the new No. 2 Brake-Thirds can be used, its end windows rendering it a suitable vehicle for motor train working as they provide a look-out for the driver when running with the coach leading. The No. 1 or M3 types of Hornby Tank engines, either electric or clockwork, are essentially suitable for these duties, and the locomotive illustrated in the lower photograph on this page is one of the No. 1 type actually so employed.



A "motor train" leaving a wayside station. It is composed of a No. 1 Tank and a No. 2 Saloon Coach as suggested in this article, and represents the useful units found in actual G.W.R. practice.

A train that would be something of a novelty on a miniature layout would be a reproduction of the famous "1.20 a.m. Newspaper" from Paddington to Newport, the fastest newspaper train in the world, with its 58.5 m.p.h. average over the 133½ miles. This could be made up of No. 2 Luggage Vans and No. 1 Guard's Vans to represent the vehicles actually employed. A point in favour of the No. 2 Luggage Van is that its wide opening doors easily permit of the loading and unloading of "bundles" of newspapers, a feature of model railway operation in which younger readers at all events are particularly keen.

G.W.R. freight services are just as characteristic as the passenger ones, and so also in many cases are the vehicles responsible for their working. A feature is that many of the fast freight trains are distinguished by more or less appropriate nicknames. The use of some of these names on a miniature line in reference to its principle freight trains would add considerably to the interest and true-to-type atmosphere of operations. Such titles as *"The Meat"* and *"The Feeder,"* or *"The Birmingham Market,"* indicate the purpose, and in the last case the destination also, of three different trains from Birkenhead to Smithfield, Pontypool Road, and Bordesley Junction respectively. Then there are suggestions of extreme usefulness about *"The Western General"* and *"The Mopper Up,"* from Paddington to Bristol.

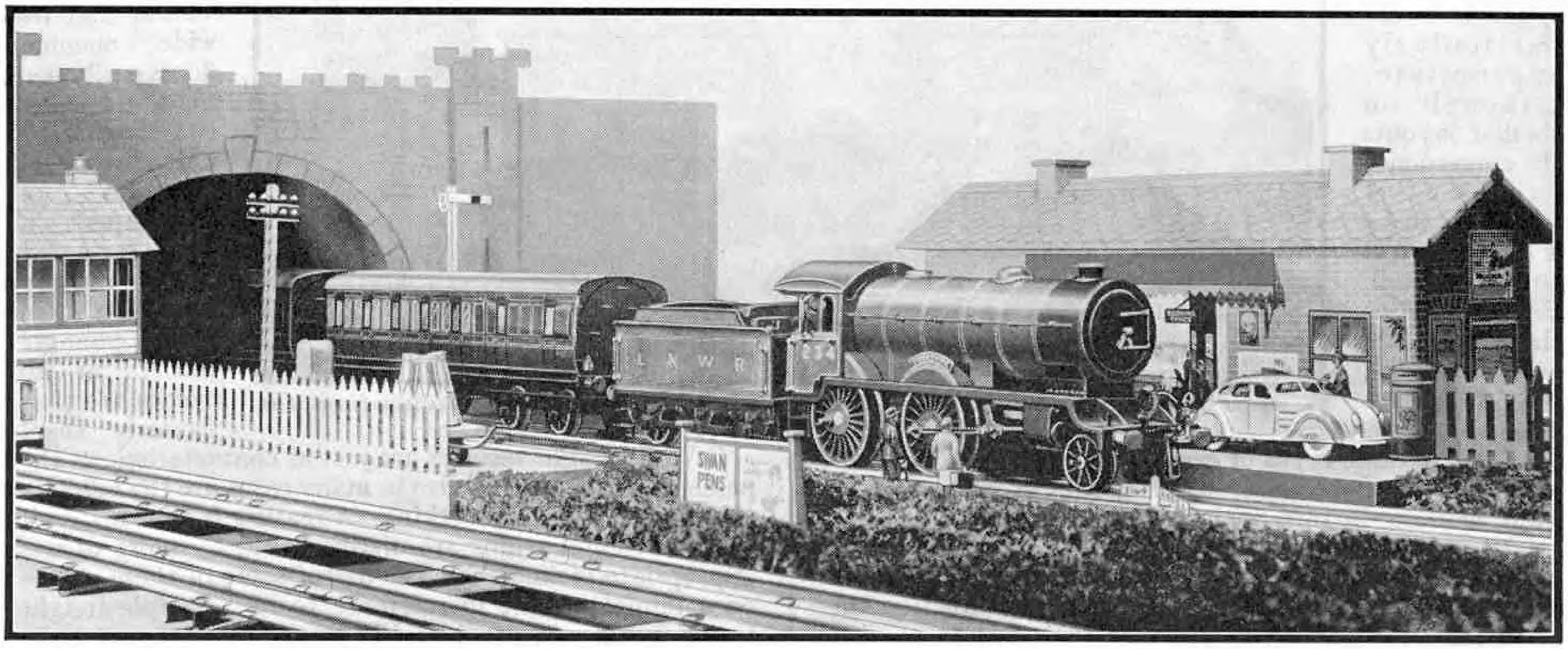
In addition to the names of their chief freight trains the G.W.R. also largely employ code names in referring to various goods vehicles. This again is a step that can be followed in miniature and, as in actual practice, time and trouble will be saved in arranging the make-up of trains by referring to the various vehicles in code. Thus a Hornby Trolley Wagon on a G.W.R. layout would be known as a *"Crocodile,"* the No. 2 Lumber Wagon would be a *"Macaw,"* and the Refrigerator Van would be a *"Mica B."* Similarly the No. 2 Luggage Van might be used as a *"Mink F"* for general goods, or as a *"Monster"* for parcels, theatrical scenery, etc., and the Milk Vans would be referred to as *"Siphons."*

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

SPOT THE ERRORS



The illustration above shows what at first glance appears to be just an ordinary normal railway view. On closer inspection however, it will be seen that the subject is full of mistakes. These mistakes have been introduced purposely in order to make the photograph form the basis of an interesting competition.

Competitors are required to point out as many mistakes as they can find. Some of the errors will be seen immediately but others are less obvious and can only be found after careful search. The photograph should be examined section by section until the competitor is sure that he has found every mistake. This contest gives H.R.C. members an excellent opportunity of showing at the same time their sharpness of eye and their railway knowledge.

When a competitor has noted every error that he can find he should make out a neat copy of his list and send this to H.R.C. Headquarters at Meccano Ltd., Binns Road, Liverpool 13, in an envelope marked *"H.R.C. Errors Contest"* in the top left-hand corner.

The Contest will be divided as usual into two Sections, Home and Overseas. The winners of the four prizes awarded in each Section will be able to choose any products of Meccano Ltd., to the value of 21/–, 15/–, 10/6 and 5/– respectively. A number of consolation prizes also will be awarded, and in the event of a tie, neatness and originality in presentation will be the chief features in the eyes of the judges.

On the back of each entry submitted must be given the competitor's age, name, address and H.R.C. membership number. Entries from competitors in the Home Section must be posted to arrive at Headquarters not later than 30th September. The Overseas closing date is 31st December.

Railway Photograph Contest

This month we announce the last of this season's H.R.C. Photograph Contests. In this, as in previous competitions in this series, prizes are offered for the best photographs of any *"Railway Subject"*; and the only restriction is that the photograph must have been taken by the competitor himself. The developing and printing may have been carried out by others. Competitors may send as many different prints as they desire, but no competitor can win more than one prize.

On the back of each entry submitted must be written the competitor's name, age and address and H.R.C. membership number. In addition to these a short description of the scene of the picture must be given.

The Contest will be divided as usual into two Sections, Home and Overseas, and prizes consisting of any product manufactured by Meccano Ltd., or of photographic material if preferred, to the respective values of 21/–, 15/–, 10/6 and 5/– will be awarded. In addition a number of consolation prizes will be given to the entries judged next in order of merit.

Envelopes containing entries should be marked *"H.R.C. September Photo Contest"* in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 30th September. The closing date for the Overseas Section is 31st December. Entries received after the announced closing dates will be disqualified. Competitors desiring their entries to be returned should enclose a stamped addressed envelope of suitable size. Prizewinning prints become the property of Meccano Ltd.

COMPETITION RESULTS

HOME

June "Jumbled Names Contest."—First: C. E. Wrayford (6039), Moretonhampstead. Second: D. J. W. Brough (8246), Cheam. Third: E. Beven (35158), Sheffield. Fourth: K. Costain (5108), Bolton. Consolation Prizes: C. Brett (5868) Great Coates; J. C. Button (10335), Crewe.

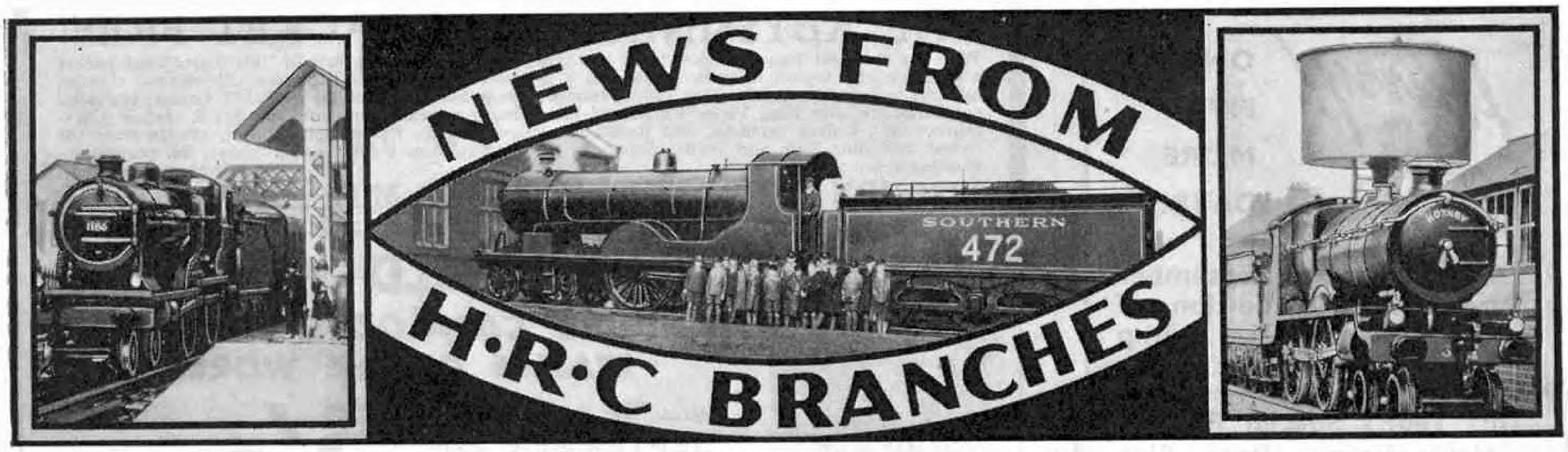
June "Railway Photo Contest."—First: E. C. Morgan (10735), Wandsworth Common. Second: L. T. A. Bern (347) Portsmouth. Third: J. W. Hague (1258) Ripon. Fourth: J. Turley (18853), Tunbridge Wells. Consolation Prizes: J. T. Wilson (42874), Edinburgh; P. Andrew (22670), New Barnet; H. Houston (28542), Edinburgh; F. Hodson (9430), Bolton.

June "Word-Building Contest."—First: G. Fairweather (42279), Lancaster. Second: D. M. Davies (40035), Mæsteg. Third: C. J. Lynch (43333), Clifton, York. Fourth: C. C. O. Young (24182), Bedford.

OVERSEAS

March "Photo Voting Contest."—First: R. A. Wragg (7913), Bandikui, India. Second: D. McLeod (29024), S. Africa. Third: J. A. Coates (23863), Canada. Fourth: W. Carpinter (42509), New Zealand.

March "Railway Photo Contest."—First: J. P. Hancock (38964), Transvaal, S. Africa. Second: J. A. Coates (23863), St. Lambert, Quebec, Canada. Third: M. de Lima (34925), Poona, India.



Branch News

BOWERHAM.—Enjoyable track meetings continue to be held and members are paying special attention to the provision of lineside scenery. Tests in skill in operation and in railway knowledge have been used to decide the positions of members in track working. Games meetings have been held and a special fund has been started for the purpose of lengthening and improving the track, now 50 ft. in length. Secretary: G. Fairweather, 44, Palatine Avenue, Bowerham, Lancaster.

NORTHAMPTON.—The first meeting of the summer session took the form of a visit to the L.M.S.R. main line at Blisworth. Notes were kept of the trains seen, and among these were the up *"Royal Scot"* and other famous expresses. Visits have been paid to the Northampton Goods Yard and Repair Sheds, and to other places of railway interest. Secretary: D. K. Adams, 8, Cedar Road, Northampton.

ST. THOMAS (EXETER).—Mr. W. A. Blake has been welcomed as Chairman of the club, and under his guidance keen interest is being taken in miniature railway working. Both L.M.S.R. and G.W.R. services are worked, and special attention has been given to goods train operation and to the running of mixed traffic. Record breaking runs between "Windsor" and "Birmingham" have been made by a No. 2 L.M.S.R. Tank, and specially speedy runs are arranged for it. Operations continue to be excellently carried out, and electric lights are flashed as signals for changing of points. Secretary: H. A. C. Adams, "Westwood," Buckerell Avenue, Topsham Road, Exeter.

GLENGORSE (BATTLE).—Special Jubilee track meetings have been held, the trains run on these occasions including "Specials" hauled by a "Royal Scot" locomotive that had been painted blue and gold in honour of the occasion. An outdoor meeting was held to celebrate the anniversary of the club, and a bank with several sharp curves was incorporated in the layout in order to test the climbing capacities of Branch locomotives. Cricket Matches were played against teams from an Eastbourne school. Secretary: A. G. Forsyth, Glengorse, Telham Court, Battle, Sussex.

NEW SOUTHGATE.—Great interest was displayed by visitors to the Branch's Exhibition, which resulted in a profit of 10/–. Outdoor track meetings have been held regularly when weather permitted, experimental layouts being thoroughly tested, and on other occasions speed and distance tests have been made, and trials of hauling power carried on tracks laid down indoors. The local Fire Station, and an excellent Model Railway Exhibition have been visited, and an interesting Lantern Lecture has been given on *"How London's Tubes Are Made,"* slides being kindly loaned by London Transport. Secretary: A. R. Wardle, 25, Limes Avenue, New Southgate, London, N.11.

ADDISCOMBE.—Enthusiastic reports on Branch track meetings are forwarded by the secretary. A particularly enjoyable event was the Anniversary meeting, for which special competitions were organised and refreshments provided. Meetings are now being held at the homes of members, and a Branch room is needed in order to provide accommodation for enthusiasts who wish to join. Secretary: G. Chandler, 62, Ashburton Avenue, Addiscombe.

ST. GILES' CATHEDRAL (EDINBURGH).—Indoor meetings were continued throughout the summer, members showing exceptional keenness in supporting the efforts of the Chairman and officials. A large track is being built up that will allow both continuous and non-continuous running, and will provide ample facilities for branch line working, goods train operation and marshalling. Signals are to be operated electrically and members are busily constructing various accessories and details of lineside scenery. Visits have been paid to the Haymarket and St. Margaret's Engine Sheds of the L.N.E.R., Granton Gas Works and the Edinburgh Transport Depot. A particularly interesting excursion was made to Rosyth, in order to see the *"Mauretania"* on her arrival for breaking up. Secretary: H. W. Govan, 18, Ravelston Park, Edinburgh, 4.

CHORLTON-CUM-HARDY.—A better Branch room has now been placed at the club's disposal and members are preparing it for track meetings. Tables are being made on which to lay an extensive track, and good times are looked for during the coming winter session. Secretary: G. H. Gill, 56, Highfield Road, Chorlton-cum-Hardy.



Members of the Glengorse (Battle) Branch, No. 275, enjoying a country ramble. Chairman: Mr. K. J. Attwell; secretary: A. G. Forsyth. This Branch was incorporated in October, 1934, and since then has met regularly for track working. Recently special trains were run to celebrate the King's Silver Jubilee, and were hauled by a "Royal Scot" painted blue and gold.

ITALY

MILAN.—Every meeting is devoted to Hornby Train operation and the acquisition of a new Pullman train and other railway material has increased interest. The Library has been enlarged, and Chemical and Electrical Sections have been formed. Good prizes were given in a Table Tennis Tournament, which was keenly contested, and Vendrogno-Taceno was visited on an enjoyable ramble. Secretary: E. Vigo, Corso Genova, 19, Milan.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below. All owners of Hornby Trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who apply.

LONDON—C. Gray, 3, Boston Road, Hanwell, W.7.

SCARBOROUGH—Mr. P. H. Horrox, College House, Holbeck Hill.

Branches Recently Incorporated

290. ISLINGTON—E. Muxlow, 7, Regents Park Road, London, N.1.



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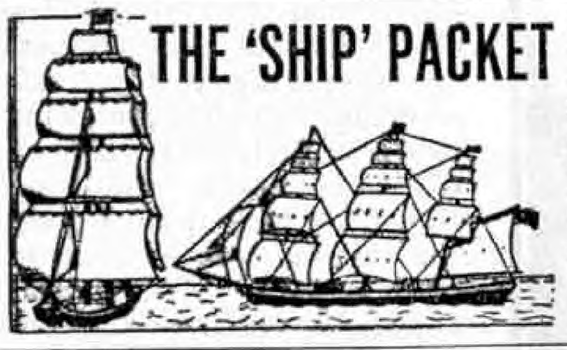
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The most marvellous **Bargain** ever offered to "M.M." readers. Includes 1d. Black 1840, Cape Triangular 1856, Beautiful Pictorials and sets. Mint and used values to 5/–. Big Catalogue value. **All Different British and Colonial.** No foreign. The whole wonderful packet on offer to "M.M." Readers only for 5/–

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FREE! 100 DIFFERENT BRITISH COLONIALS FREE!

This wonderful offer of the World's most popular stamps, from most of the colonies of our Empire, includes pictorials, commemoratives, high values, bird, ship and animal stamps, out-of-the-way stamps. Long sets, many new issues, etc. ABSOLUTELY FREE TO GENUINE APPROVAL APPLICANTS WHO SEND 2d. FOR POSTAGE. **J. BURTON, 9, Harrison Drive, Bootle, Liverpool 20.**

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EDWARD SANDELL, 10, EVELYN GROVE, SOUTHALL, MIDDLESEX, ENGLAND.



Stamp Gossip

and Notes on New Issues



More Jubilee Issues

This month we are able to reproduce specimens of the Jubilee stamps issued by Australia, India, New Zealand and South Africa, to complete our series of illustrations of Jubilee issues.



Probably Australia's issue will be singled out as the most arresting of the four, if perhaps a little disappointing in its artistic merit. The design shows King George in the uniform of a Field Marshal, mounted on his charger *Anzac*, a gift to him from the people of the Commonwealth. There are three stamps in the series, 2d., 3d. and 2/–, and each employs the same design.

The Indian series is of exceptional interest, for each of the seven stamps features an outstanding piece of Indian architecture.



First of all, however. students of design should study the insignia of the Order of the Star of India surrounding the King's portrait on each stamp. The collar consists of representations of red and white roses, two palm branches tied together and the lotus flower. At the bottom is the Imperial Crown, suspended from it is the Star, and below that an onyx cameo of Queen Victoria, who founded the order.

The outstanding of the seven designs is the 2½a. value, illustrated. This shows the Taj Mahal, the most wonderful piece of Mohammedan architecture, and India's most treasured show place. The Taj Mahal was built in the 1650's by the Shah Jehan, as a tomb for his wife, Mumtaz Mahal, and himself.

The other designs are as follows:—1½a., the Gateway of India, Bombay; 9p., the Victoria Memorial, Calcutta; 1a., the Dravidian Temple at Rameswaram, Madras, believed by the Hindus to have been built, by the God Rama himself; 1¼a., Badri Das Temple of the Jainist Sect at Calcutta; 3½a., the Golden Temple at Amritsar, the holy city of the Sikhs. This temple derives its name from a burnished copper roof that shines like gold in the sunshine. Last of all there is the 8a. stamp, which shows a Buddhist pagoda at Mandalay, Burma.

The New Zealand issue is specially notable for the really splendid portraits of Their Majesties that are used in the design. We are sure most of our readers will agree that these are easily the best of the Jubilee stamp portraits. The design shown here is used in each of the three stamps in the series, ½d., 1d. and 6d.

South Africa's design is the simplest of all the Dominion designs. The King's head is shown superimposed on a rising sun. The inscription is in English and Afrikaans—with the position of the languages interchanged on alternate stamps—and at the sides there are springboks leaping over the value tablets.

This series contains four stamps, ½d., 1d., 3d. and 6d., each using the design illustrated.

New B.E. African Issue

With the exception of one design, that used for the 10c. and £1 values, the new series issued for use in the combined East African territories, Kenya, Uganda and Tanganyika, is well up to the recent high standard of British Colonial stamp design. The exception is the result of striving to get an outstanding effect by unusual methods. The stamp shows at the foot and sides silhouettes of a lion and a group of palm trees, and a curiously chequered oval containing the King's portrait. The names of the three territories are superimposed in plain white lettering against the silhouetted foreground. The effect is certainly unusual, but unhappy too.

We have chosen for illustration the much more pleasing design used for the 1c., 20c. and 10/– values. In this the King's portrait is framed by elephant tusks and flanked by a pair of the very handsome Kavirondo cranes. These birds, which sometimes are known as Crown birds, inhabit the Kavirondo Gulf area of Lake Victoria. The great Lake Victoria, 2,600 sq. miles in extent and Africa's largest inland lake, is shown on the 5c. and 50c. stamps.

The remaining designs are as follows:—15c. and 2/– Kilimanjaro, Africa's most famous mountain, 19,321 ft. in height, an extinct volcano located in Tanganyika territory; 30c. and 5/–, a portrait of the King, and at the foot of the stamp a view of the Jinga Bridge, carrying the Uganda-Mombasa railway over the River Nile, near to the Ripon Falls; 65c., an aeroplane in flight over Mount Kenya (17,000 ft.); 1/– and 3/–, a view of Lake Nauvasha, near Nairobi.

* * * *

New pictorials are now being prepared for Nigeria, St. Lucia and Samoa. We hope to illustrate specimens in an early issue.

New Pictorials for Ceylon

An interesting addition to a collection of native industrial designs is provided by Ceylon in its new pictorial issue. The 2c. stamp, illustrated here, shows a native woman collecting latex from a tapped rubber tree. Rubber planting is Ceylon's third most valuable industry, the exports in recent years being valued at nearly one million pounds per annum.



The 25c. stamp from the same issue will be of special interest to collectors of architectural stamps. It shows a view of the Dalada Maliganea, the Temple of the Tooth, at Kandy. Tradition has it that the temple houses one of Buddha's teeth, and on rare occasions the relic, a piece of discoloured ivory 2 in. in length and 1 in. in diameter, is shown. At all other times it reposes in the innermost of seven shrines, the inner six of which are of pure gold crusted with jewels.

A very delightful river scene appears on the 15c. stamp, and when the remaining issues of the series appear on 1st January next, following the withdrawal of the Jubilee stamps, a most interesting series will be available. The stamps yet to be issued are the 3c., 6c., 9c., 20c. and 50c. values.

* * *

From time to time we have drawn attention to interesting postmark slogans. A new one from Jamaica is probably the most novel greeting ever extended to a Royal visitor. It was issued on the occasion of the Duke of Gloucester's visit to Kingston in April last, and reads: "*Jamaica welcomes H.R.H. The Duke of Gloucester.*"

* * *



Among the most interesting new issues of recent months are the £2 and £5 stamps issued in New Guinea. At first sight such high values would seem to be unnecessary, but in this instance it is probable that the whole issue will be used for real postal purposes by the big gold mining companies operating in New Guinea. The easiest way of despatching the output from the mines is by air mail and usually the gold is compressed into bricks of 750 ounces, on which postage of 3½d. per ounce may be payable, approximately £11 per package, including coverings.

The "TRANSPORT" Packet

contains a wonderful assortment of 44 all different Foreign and Colonial stamps and includes the following which depict various means of transportation: **TUNIS** (Water Carrier), **JAMAICA** (Troopship), **MADAGASCAR** (Native Transport), **GREECE** (Steamer), **INDO-CHINA** (Boat), **MAURITANIA** (Crossing Desert), **TRANSVAAL** (Waggon), **BRAZIL** (Aeroplanes), **MIDDLE-CONGO** (Train), **SUDAN** (Camel), **FRANCE** (Horsewoman), **DUTCH INDIES** (Steam-boat), **AUSTRALIA** (Aeroplane), **GABOON** (Raft), **COLOMBIA** (Natives with Panniers), **SOUTH AFRICA** (Ship), **FRENCH GUIANA** (Native Carriers), **GERMANY** (Aeroplane), and **BELGIUM** (Train). Price **6d.** (abroad extra). All purchasers of this packet asking for approval sheets will be presented with **INDIA** Silver Jubilee Stamps.

BURDOCK & FLURY
4, MARLBOROUGH ROAD, LONDON, S.W.19

MINT VARIETY PACKET FREE

This wonderful offer contains new and recent issues from 12 different countries of the world—all unused—including beautiful Colonial Pictorials, and is absolutely **FREE** to all genuine applicants for approvals. (None sent abroad.) Postage paid both ways.

T. F. WILLIAMS,
7, Islington Road, Towcester, Northants.

"DIAMONDS"

MANY RARE STAMPS have been found by purchasers of **The "DIAMOND" Packet**, which contains approximately **1,000 UNSORTED STAMPS** from Convents abroad.
1 pkt. 1/6. 3 pkts. 3/9. 5 pkts. 6/-.
All post free. (Abroad 3d. per pkt. extra.)

O. NERUSH
(Dept. K), 68, TURNPIKE LANE, LONDON, N.8, ENGLAND.

FREE! FREE! FREE! Triangular Pkt.

Lithuania Air Mail Triangular (Mint). **Bermuda** (Sailing Vessel, Mint). **Niger** (Mint). **Maroc** (Mint). **Turkey** (Ruler), and a set of **5 Ceylon** stamps. Enclose 2d. for postage and packing and **request approvals.**

SHOWELL BROS.,
42, VANBRUGH HILL, LONDON, S.E. 3

HERE'S YOUR CHANCE. No gifts, but exceptional value for your money. Thousands of attractive stamps at ¼d., ½d. and 1d. each, and **Rare** items for the advanced collectors. Don't miss my **Bargains.** Write immediately. You will be astounded at my ⅛th catalogue prices.
CAMPBELL, HALDON AVENUE, TEIGNMOUTH.

BRITISH COLONIAL JUBILEE STAMPS

I have a few **Mint Sets** of the following:

Bahamas ...	... 3/-	Malta ...	... 2/9
Bermuda ...	... 2/4	Nive ...	... 1/3
Gibraltar ...	... 3/-	Samoa ...	... 1/3
Morocco A ...	... 1/-	Sierra Leone	... 3/-
Cook Is. ...	... 1/3	S. Rhodesia	... 1/9

Cash with order. Postage extra.
H. L. GOMM, 41, Upper Cranbrook Rd., Redland, Bristol 6

I WANT 500

regular customers. Collectors who are so satisfied with the value offered in my selections that they will come to me for all their philatelic requirements. AND I have a scheme which will pay them to become **regular** customers.
Send now for my **4-a-penny selections** and full particulars of the new scheme.

L. D. MAYNARD,
78, RICHMOND ST., SOUTHEND-ON-SEA.

CHEAP APPROVALS

My beautiful Approval Selections are ideal for filling those vacant spaces. Pictorials, Colonials, and hard to get items. Selections from 4 a 1d. Free Gift Bi-coloured Persia all applicants.

A. V. TAPP,
108, CHESTERFIELD ROAD, BRISTOL.

SEPT. THE SEASON OPENS 1935

FREE To mark the opening of the Philatelic Season we are presenting this month a magnificent collection of quality stamps including **MALTA SILVER JUBILEE STAMP,** unused, **AUSTRALIA JUBILEE,** showing H.M. King George on "Anzac," fine SAAR PICTORIAL, South West Africa (Cape Cross), Iraq, Sunni Mosque, Muadhdham, INDIA JUBILEE STAMP, view of Jain Temple, Calcutta, Tanganyika, new pictorial issue, unused. **FREE**

Send a P.C. for approvals and this wonderful packet will reach you by return of post.

THE UNIVERSITY STAMP CO., 13, WALTON WELL ROAD, OXFORD

BASEBALL AND HURLEY PACKET FREE!!

This splendid **FREE GIFT** contains mint **PHILIPPINE ISLANDS** showing game of baseball in championship games, used **IRELAND** Gaelic Athletic Ass. Commem. (hurley player in action), mint stamps from **SYRIA** (pictorial), **FR. OCEANIC SETTLEMENTS** (native spearing fish), **GREECE** (ship in isthmus), **ANGOLA** (1934 Ceres type), **FR. SOUDAN** (native woman), **TURKEY** (surcharged pictorial); also **BR. COLONIALS** including **N. RHODESIA** (giraffe and elephants), **CYPRUS,** etc.; complete set of **DENMARK** caravels, **SIAM,** etc.; **ABSOLUTELY FREE** to genuine applicants for my free gift approvals enclosing 2d. for postage (abroad 1/-).

HELY. HUTCHINSON (M.1), HURROCK WOOD, KENTS BANK, GRANGE-OVER-SANDS

ONE THOUSAND STAMPS on APPROVAL

From which you may select any 100 for 3/-.

This selection is not made up of the very commonest varieties, but contains stamps catalogued at 1/- each or more. (I do not sell less than 100.)

During this month, as an additional attraction, a stamp catalogued at least 3/- will be included. Can you find it?

H. HARDY, "Hoyland," Potter Heigham, Norfolk.

THE FIRST STAMP Ever Issued

(British 1840 Penny Black) for P.O. 2/-! It is guaranteed genuine in every respect. Its companion stamp (1840, 2d. blue) for a further 5/- (cat. 20/-)! Other "Classics" which every Collector should have are the **Cape of Good Hope Triangulars;** we offer 1d. rose (cat. 40/-) for 12/6; 4d. blue (cat. 15/-) for 5/-; and 6d. lilac (cat. 60/-) at 15/-. Superb approvals of any country against approved English References or a deposit. **Full Lists Free.**
NORRIS & CO. (Dept. M), NORWOOD, LONDON, S.E.19

FREE SET OF MINT POLAND

to all Stamp Collectors sending 1½d. postage.
100 different Foreign and Colonial, 4½d.

A. F. LANGTON
40, COPPERFIELD AVENUE, HILLINGDON, MIDDX.

SILVER JUBILEE ■ UNION OF SOUTH AFRICA
USED SET OF 4 ENGLISH OR DUTCH FOR ONLY 1/8 POST FREE.
George Lazenby, 16, Redburn Drive, Shipley, Yorks.

SPECIAL SUMMER OFFERS
100 PERSIA. All diff. incl. Air & Coronation **2/7**
20 NYASSA. Very handsome-animals, Mint **1/3**
3 GREAT BRITAIN. K.G. 2/6, 5/- & 10/- **1/5**
7 INDIA-JUBILEE SET. Complete, Used **1/3**
10 JUBILEE COLONIALS, Mint, diff. ... **1/-**
15 for **1/6**; 20 for **2/3**; 25 for **3/-**; 30 for **4/-**
JUBILEE and NEW ISSUE APPROVALS—PLEASE STATE INTERESTS. CASH WITH ORDER for above packets—POST EXTRA.
T. R. HUGHES,
7, Winchester Road, Swiss Cottage, N.W.3.

THE MYSTIC PACKET

1000 UNKNOWN UNUSUAL UNSORTED 1/3

Stamps on paper, etc., just as received from Convents, Missions, Bankers, etc. Guaranteed unpicked. Chance of a **FIND** in every lot. Send to-day for your treasure hunt to-morrow, **3** for **3/6, 6** for **6/6.** Abroad, **1/6** packet. **FREE!** 25 Br. Cols., including Jubilees, to approval Applicants. also **FREE EXCHANGE.** Send postage only. Overseas **3d.**

ASTLEY & CO.
(M25), Lowhill, WOLVERHAMPTON

SENT BY AIR MAIL

Celebrated **Richemont 6d.** and 1/- packets, sets and singles sent on approval by **Swiss Air Mail.** New set **Swiss Pictorials** mint 2/-, used **4d.**

A. M. PHILLIPS,
Richemont, St. Légier, Sur Vevey, Switzerland

Fine Opportunity. Foreign and Colonial stamps. Collector disposing of duplicates in packets of 50 stamps. Price 6d. and 1/- per packet. Post free.—Wickersham, 33, Ninfield Road, Bexhill-on-Sea.

Request Approvals. If 1/- spent, 100 Stamps, Stamp Outfit free!—G. Kingsmill, New Barnet, Herts.

100 diff. Stamps Free to approval applicants, good discount.—Gosling, 21, Powling Road, Ipswich.

Six Colonial Silver Jubilee Stamps Free.—Sanders, 90, Newlands Avenue, Southampton.

100 Different Stamps Free to applicants for ½d. approvals.—Cox, 21, Dennis Mansions, Westcliff.

Free Gift Packet, Nicaragua, Salvador, Ecuador, Pictorials, Air Mails, etc. Enclose 2d. for 4 a 1d. approvals—N. P. Embley, 39, Cross St., St. Annes.

WRITING PADS FOR MECCANO BOYS



These Writing Pads are very popular with Meccano boys as is shown by the large number of letters we receive each day written on the familiar tinted paper.

The Pads are supplied in two sizes, each consisting of 50 sheets and cover.

Prices—Large Size 1/- each (post free). Small Size 6d. each (post free).

ENVELOPES.

Special envelopes, appropriately printed and matching the writing paper in colour, are also available. These are suitable for both the large and the small sheets of writing paper.

Price, per packet of 50, 8d. post free.

Meccano Ltd., Binns Road, Liverpool 13.

NYASALAND JUBILEE PACKET FREE!

This **Wonderful** packet contains a **Large NYASALAND JUBILEE PICTORIAL;** a fine **Egyptian AIR MAIL pictorial; Indian, Jubilee Pictorial; Sudan,** pictorial; U.S.A. **Bicentenary; Mozambique,** unused; **French Peace;** China, **Sun Yat Sen;** Nigeria; **Gold Coast;** and finally a fine **Hindenburg Birthday Commemorative. ALL FREE** to applicants sending 1½d. postage and requesting our **high-class** approvals which contain many **JUBILEE** stamps. **THE PUKKA STAMP CO., 27, Normandy Ave., BARNET.**

The Cayman Islands Pictorials

This set of 12 stamps is a most attractive addition to the British Colonial pictorial group. Its five designs are exceptionally interesting, and the printing is delightful.

The design illustrated here, used for the 1d. and 2/– values, probably is the most interesting, for it illustrates a species of gannet, known locally as the "Booby bird." Just how the name is derived is a little obscure, but *"Gibbons' Stamp Monthly"* suggests that it is because of the ease with which it may be caught. Trappers paint a rough picture of a herring on a piece of board and tow the board submerged behind their boat. The Booby bird dives from a great height to secure its prey, and breaks its neck on the board!



The 2½d., 6d. and 5/– values are also of special interest to the student of natural history. These three stamps share a design showing an island beach and a number of hawksbill turtles. The shell of these turtles is of great commercial value—it is the origin of most genuine tortoiseshell spectacle frames—and hunting the hawksbill is one of the principal occupations of the islanders.

The design on the ½d., 2d. and 1/– values provides a companion to this design, for it shows one of the small single sail boats used in turtle catching.



The remaining designs are as follows: ¼d. and 3d., a map showing the three islands comprising the Caymans group. At the bottom of the stamp are dolphins, and surrounding the King's portrait is a circlet of thatch rope, made from the Thatch palm. It is an interesting sidelight on the meticulous care that is exercised in modern stamp designing that Messrs. Waterlow and Sons, who designed and produced these stamps, were actually supplied with a sample of thatch rope to ensure a perfect rendering of its detail.

The 1½d. and 10/– values are representative of the Islands biggest industry, coconut planting.

Anzac Commemoratives

To celebrate the 20th anniversary of the landing of the Anzac forces at Gallipoli on 25th April, 1915, Australia issued two special commemorative stamps—2d. and 1/– values. Each stamp bears a design showing a representation of the Cenotaph in Whitehall, encircled by a wreath of laurel. The stamps were on sale for a limited period only, and each bore a premium, the proceeds from which were to be devoted to ex-servicemen's charities.

The name *Anzac*, as most of our readers know, is a contraction formed from the initials of the famous Australian and New Zealand Army Corps.



Birds on Stamps

One of the interesting features of the many new British Colonial pictorial issues has been the tendency to adopt interesting ideas used in earlier pictorial issues by other Colonies. To describe the tendency as copying would be harsh; rather does it savour of national pride in refusing to admit that some similar feature in another Colony can possibly be of equal interest.

As a result we have had given to us recently a most interesting range of stamps depicting birds, and in selecting specimens from the new issues of the Cayman Islands and Kenya, Uganda and Tanganyika, we have deliberately chosen the bird designs to illustrate the fascinating range of bird stamps that are available to the collector who desires to form a collection of such designs.

In addition to the three stamps we show this month, the Falkland Islands, Bahamas, Ascension, Australia, and New Zealand, have also included bird designs in their recent issues. The new Bahamas 8d. pictorial illustrated here shows a group of flamingoes in flight. The curious flight of the bird, its head, neck, body and long legs all outstretched in horizontal plane, is well illustrated. The flamingo family is well distributed throughout the warmer climates of the world, but all the birds shown here are of the exclusively American variety, *Phoenicopterus Ruber*.

A Mail Transport Stamp

In the June *"M.M."* we included an illustration of the new Spanish-Moroccan express stamp, showing a Moorish courier, and suggested its inclusion in a collection illustrating the story of mail transport. This month we have a further addition to such a collection, for the 10c. Brussels Exhibition Commemorative stamp, shown here, depicts an early Belgian mail coach drawn by five horses. The same design is used for the other two stamps in the set, 25c. and 35c.

Cryptic Addresses

Most business houses receive some quaintly addressed correspondence in the course of a year, and it is very rarely that the Post Office are at a loss when endeavouring to interpret the intentions of the senders of such missives. Only a few months ago we received at this office a letter from a reader in New Zealand addressed "M.M., Binns, England." But even this was beaten by a letter recently received by Stanley Gibbons Ltd. from an American schoolboy, addressed "The Silver Jubalee, London."

The reason for its arrival at 391, Strand, was that coupled with some interesting comments concerning the King's Jubilee, the letter requested a few Jubilee stamps. His optimism deserved its reward.

The New Whitfield-King Catalogue

The coming of September heralds a new stamp season and, although this summer has been notable for the well-maintained interest in stamp collecting, stimulated by the press of Jubilee issues, the next few weeks will be exceptionally busy ones behind the scenes in stamp dealers' offices, particularly so in those that carry the burden of an annual catalogue. The first of the new season's catalogues—the Whitfield King—will be on sale when this note appears in print.

Messrs. Whitfield King tell us that, in addition to a big number of revisions in pricings, many of the lists have been widely extended and amplified by the inclusion of additional data, and the whole catalogue has been reset in clearer, easier-to-read type. There will be more than 6,600 illustrations.

The most welcome feature of all, however, is the reduction in price to 5/–. The great popularity of the Whitfield King catalogue in recent years has made this step possible, and undoubtedly it will lead to even greater success, for the catalogue is excellently suited to the needs of young collectors and those who do not care to go closely into the fine complications of shades, watermarks and perforations.



Testing Line-Engraved Stamps

In a recent issue of *"Gibbons' Stamp Monthly"* an interesting and simple test for line-engraved stamps was described. As most of our readers know, in this method of printing the design of the stamp is cut into the surface of the printing plate, and after the plate has been inked the surface is wiped clean so that printing ink is deposited only in the cuts. In the printing process the impression is obtained by forcing the paper into the cuts, and the ink thus stands out in relief on the surface of the stamp. In most cases this relief impression can actually be felt by pressing the fingers lightly over the stamps.

In a small number of cases, however, the relief is not strong enough to answer to this test. In such cases a sheet of silver paper



may be laid over the stamp and rubbed lightly. It is surprising how clearly the lines of the design can be brought up on the paper in response to this test.

* * * *

Among our illustrations this month we give two of stamps mentioned in the April *"M.M.,"* New Zealand's new air mail design, and the 75 dr. value, showing a recently completed cement works near Teheran, from Persia's new pictorial issue.

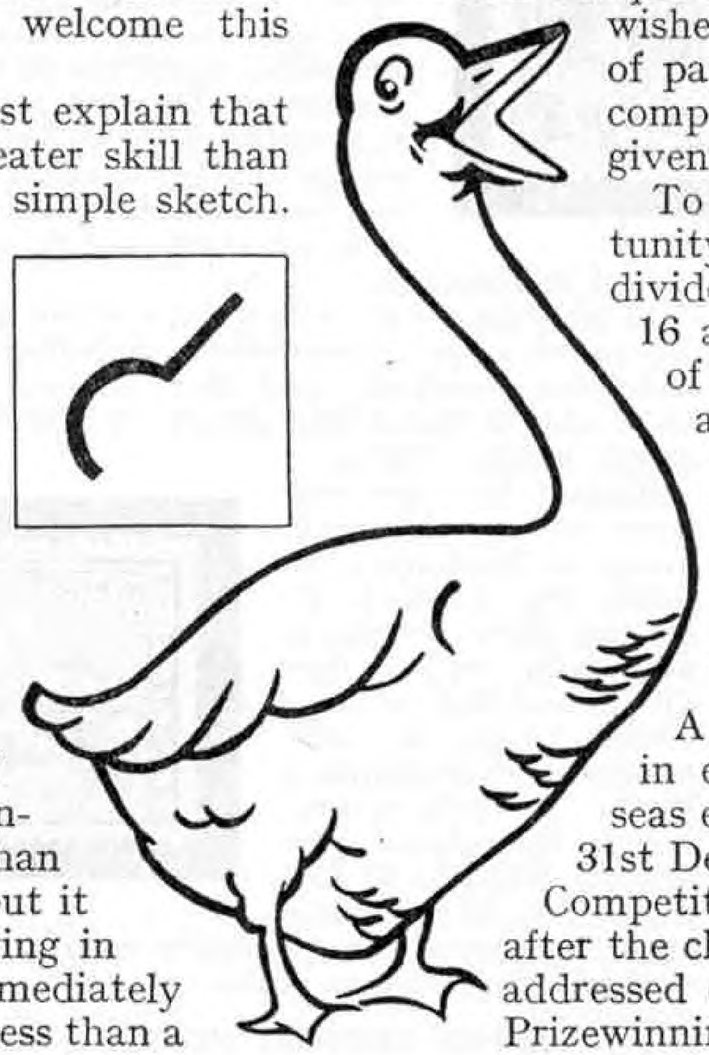
We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Competition Corner

SKETCHOGRAMS

It is quite a considerable time since last we announced a Sketchograms Competition, and we are sure that all our artistic readers, and very many of those who make no pretensions to drawing skill, will welcome this amusing and simple competition.

For the benefit of new readers we must explain that the art of sketchograms calls for no greater skill than the ability to include a given line, in a simple sketch. To make the point clear, our sketch shows the sketchogram in a little box balanced on the back of a goose, while the sketchogram itself is incorporated in the goose's head, and for explanatory purposes has been thickened considerably to make it clearly visible.



Competitors are asked to submit original sketches in which the line is used in a similar way. It may appear in the sketch as many times as the competitor desires, and may be tilted to any angle or turned upside down if desirable. Competitors who succeed in incorporating the sketchogram more than once will be given credit for the effort, but it must be emphasised that a simple drawing in which it appears but once, and is immediately obvious, will stand a better chance of success than a complicated drawing in which the sketchogram appears several times merely as a minor feature.

Each competitor may submit as many drawings as he wishes, but each must be on a separate sheet of paper, and on the back of each sheet the competitor's name, age and address must be given.

To give our younger readers an equal opportunity of gaining a prize the entries will be divided into two sections, A for readers aged 16 and over, B for those under 16. Prizes of Meccano Products, or Artists' Materials as the winners prefer, to the value of 21/– and 10/6 respectively, will be awarded in each section.

Entries must be addressed "Sketchograms, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th September.

A similar set of prizes will be awarded in exactly the same conditions for Overseas entries, which must arrive not later than 31st December.

Competitors who desire their entries to be returned after the close of the contest must send a stamped addressed envelope of suitable size with the entry. Prizewinning entries are retained by the Editor.

September Photo Contest

With this month's competition our present series of Photo Contests comes to an end, and we hope that all those of our readers who own cameras but have not yet submitted an entry to an "*M.M.*" photo contest, will make a point of sending along one of their holiday snapshots this month.

The conditions of our photo contests are exceedingly simple. Any subject is eligible. Any make of camera, plate, film or paper may be employed, and the only restriction is that the exposure must have been made by the competitor himself. Developing and printing may have been done professionally. The competitor's name, age and address must appear on the back of each print submitted. Competitors should note that it is not sufficient to indicate the age group only.

The entries will be divided into two sections, A for competitors aged 16 and over, B for those under 16, and prizes of Meccano Products or Photographic Materials—to be chosen by the winners—to the value of 21/– and 10/6 respectively, will be awarded in each section.

Entries should be addressed "September Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 30th September. A separate set of prizes will be reserved for competition among Overseas readers, whose entries must arrive not later than 31st December.

Holiday Stories Contest

For the majority of our readers no doubt their 1935 summer holiday is already a thing of the past, a glorious but fading memory of sunny days by the sea or the river, in the country or up on the moors.

We are always interested to know how our readers have spent their holidays and this year we are offering prizes to the readers who send us the most interesting letters relating outstanding episodes of their holidays. We are concerned only with the fun of the holiday, and in submitting entries readers should try to imagine that they are writing to their chums, and proceed to tell the story accordingly. Spelling will not be taken into account unless it becomes too original!

The prizes will consist of Meccano products value 21/–, 15/–, 10/6 and 5/– respectively and they will be awarded to the best four letters in order of merit.

Letters must not exceed 500 words in length and should be addressed "Holiday Stories, Meccano Magazine, Binns Road, Liverpool 13." They must arrive not later than 30th September.

A similar set of prizes will be reserved for entries from Overseas readers whose entries must arrive not later than 31st December. For the benefit of readers living in countries whose seasons differ from the English seasons, Overseas entries may relate incidents from any holiday of recent years.

COMPETITION RESULTS

HOME

July Crossword Puzzle.—One of the outstanding features of our Competition Corner in recent months has been the well maintained popularity of the Crossword Puzzle Competitions. No doubt this may be taken as a tribute to our practice of setting the puzzles for amusement only, but on occasion the extraordinary flood of entries has proved embarrassing and on every occasion the award of the prizes has had to be made on the basis of neatness and novelty of presentation.

This month the judges have had to differentiate between nine entries of exceptional merit and ultimately they decided to add a number of consolation prizes to the list so that some acknowledgment at least could be made to those who only narrowly missed gaining a major prize. The awards were as follows: 1. J. Hart (Wallasey); 2. R. P. and J. C. Walford (Lustleigh, Newton Abbot); 3. P. J. Hilder (London, E.2.); 4. E. B. Budd (Tottenham, N.17).

July Photo Contest.—First Prizes: Section A, V. L. Breeze (Lewes, Sussex); Section B, C. Needham (Folkestone). Second Prizes: Section A, A. B. Bishops (Bristol 4); Section B, H. Gunson (Batley).

OVERSEAS

April Photo Contest.—First Prizes: Section A, B. B. Silan (Perak, F.M.S.); Section B, J. Gandy (Vancouver, Canada). Second Prizes: Section A, H. Sant Fournier (Valletta, Malta); Section B, J. M. Demanuele (Malta).

April Advertisement Contest.—Now that the Overseas Section for this competition has closed we are permitted to give the solution to this competition which aroused so much interest among our readers both at home and overseas. The hidden advertisements were taken from the following advertisements: Hamley Bros. Ltd.; Hornby Trains (page xi); C. C. Wakefield and Co. Ltd.; B.S.A. Guns; Ilford Ltd.; The Renold and Coventry Chain Co. Ltd.; International Correspondence Schools Ltd.; The Cooper-Stewart Engineering Co. Ltd.; Kemex Chemistry Outfits; Lines Bros. Ltd. (page iv); Dunlop Rubber Co. Ltd.; H. Hardy; F. E. Dickinson; Edward Sandell; Apex Inflator Co. Ltd.

The prizes in the Overseas Section were awarded as follows: 1. H. J. Turner (Perth, W.A.); 2. R. H. Stuart (Ohakune, N.Z.); 3. Miss Bedlington (Milford, N.Z.); 4. P. Chapman (Christchurch, N.Z.).



HE KNEW TOO MUCH!

"Hey, mister, do you know enough about football to act as referee?"

"Mon, I know enough about football not to."

* * * *

He (reading book): "The maid swept the room with a glance . . ."

She: "Humph! A lot of cleaning that would do!"

* * * *

"You say McTavish is building a house?"

"Yes, and yesterday he telephoned to the Masonic Temple and asked them to send a couple of Free Masons!"

* * * *

A Scot decided to go into the fish business. So he wrote the following letter to the suppliers:

"Dear Sir,—I enclose P.O. value 2s. and shall be glad if you will kindly send a basket of fish as per advertisement. Do not send cod, hake, plaice or flukes, but send some middle cut salmon, a few lobsters, and make up the weight with oysters." A few days later he received a reply as follows:

"Dear Sir,—Your P.O. to hand. It is a pity you did not send another sixpence, then you could have had the trawler."

* * * *

First Pupil (to second pupil in electrical lab.): "Keep your hands away from those transformer terminals if you don't want to get burnt up."

Prof. (dryly): "Don't worry; anything as green as that won't burn."

* * * *

When the pithead baths first opened at a certain coal pit, a miner, trying the baths for the first time, was unable to cleanse himself from the coal dust and grime. After a few attempts with the shower spray he called to the attendant, "Hey, Bill! This watter's mucky." The attendant smilingly replied: "Tha' ad better try takin' thi cap off."

* * * *

Conjurer (to small boy): "Your mother can't get eggs without hens, can she?"

Boy: "Oh, yes—easily."

Conjurer: "How's that?"

Boy: "She keeps ducks."

* * * *

Strict Manager: "Why do you keep your pen in the ink so long?"

Clerk (who has just applied for rise in salary and is working hard to justify it): "To cool the nib, sir."

* * * *

GOOD FOR THE TROUT

Hook: "Is this a good stream for trout?"

Bate: "Splendid! I have been fishing for a week without catching one."

* * * *

Diner: "Here, waiter, I thought I ordered a chop?"

Waiter: "Yes sir, there it is."

Diner: "Oh, you surprise me, I thought it was a crack in the plate!"

* * * *

Bill: "Those cakes of Mrs. Smith's at tea were as hard as iron."

Jill: "Yes, I know. I suppose that's why she said, 'Take your pick,' when she handed them round."

* * * *

Smith: "How is your new wireless set, Jones?"

Jones: "Oh, like an express."

Smith: "What do you mean?"

Jones: "It whistles at every station."

* * * *

At a certain hotel an Englishman, an Irishman and a Scotsman were arguing as to which of their respective countries had the lightest men.

The Irishman said: "We have men of Cork."

"That may be, "said the Scotsman, "but we have men of Ayr."

"Well," said the Englishman, "that is certainly very light, but we have lightermen on the Thames!"

OBVIOUSLY!

The examiner was asking questions about life-saving. "When the rescuer dives in, what is the first thing that happens?"

"He gets wet," replied one young hopeful.

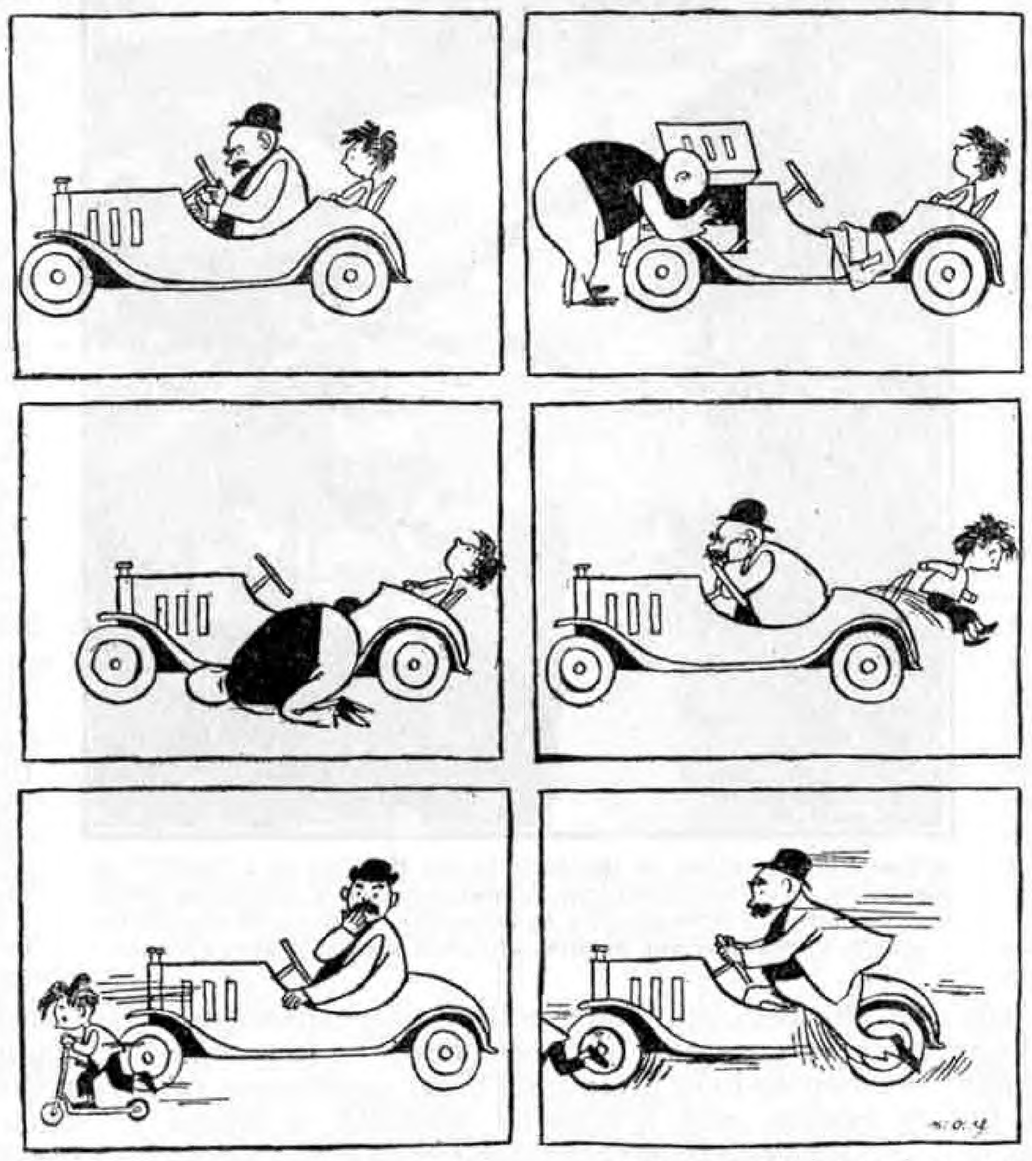
* * * *

Sandy: "Yon suit is looking a bit shabby, Jamie. Why don't you have it turned?"

Jamie: "Mon, this suit has-na three sides!"

* * * *

THE YOUNG IDEA!



"Berliner Illustrierte Zeitung."

The bus was crossing Westminster Bridge. "Say, conductor," said the American, "What is the name of this stream here?"

Hastily the conductor looked over the side. "Dash it!" he said, "The radiator's leaking again."

* * * *

Pat (visiting hospital): "And what is your trouble?"

1st Patient: "Tonsilitis. Got to have my tonsils out."

Pat: "And you?"

2nd Patient: "Blood poisoning. Got to have my right arm off."

Pat (departing hastily): "This is no place for me. I've a cold in my head."

* * * *

Shop Assistant: "This, sir, is the very latest life-saving belt."

Customer: "Is it absolutely reliable?"

Shop Assistant: "Well, sir, we've sold hundreds and no customer has ever come back."

* * * *

First Soldier: "Where were you when the battle was raging?"

Second Soldier: "I was right where the bullets were thickest."

First Soldier: "Where was that?"

Second Soldier: "Under the ammunition wagon."

* * * *

Mother: "Tom, what is the baby crying for?"

Tom: "He dug a hole in the garden and wants to bring it in the house."

STRATEGY

Benjamin Franklin was travelling in cold weather and saw no vacant place at the tavern where he could warm himself. He cried out the order, "Half a peck of oysters in the shell for my horse!"

Immediately the fireplace crowd rushed out to see a horse eat oysters. Soon they came back and told him his horse wouldn't eat oysters.

"Won't he?" asked Franklin, now comfortably seated by the fire. "Bring them in, then, and I'll eat them myself."

* * * *

Teacher (during examination): "I hope I didn't see you look at the next boy's paper, Jones?"

Jones: "I hope you didn't, either, sir!"

* * * *

Sam: "Have you heard about that fellow Blogs who is trying to graft a rubber plant on an orange tree?"

Ted: "Yes, I can't make out if he is trying to get an orange that will bounce, or rubber that can be made into gum with an orange flavour."

* * * *

The inspector, examining the class, began with Sammy Slim, the star pupil. "Well young man, can you tell me what a blizzard is?"

"Yes," promptly replied Sammy, "the inside of a hen."

* * * *

"Might I ask who lives here?"

"Certainly, sir."

"Who is it?"

"I haven't the slightest idea."

* * * *

He was trying to impress his listeners with tales of his high-speed travelling.

"We were going so fast," he said, "that when I held out a stick it went rat-tat-tat on the milestones."

* * * *

A short-sighted old lady entered a large curio shop, and, after pottering around for a while, asked an assistant: "How much is that Japanese idol by the door worth?" "A great deal," replied the assistant, "that's the proprietor."

* * * *

Lady: "Why do you waste your time begging? You should be working."

Tramp: "Did you ever beg?"

Lady: "No!"

Tramp: "Then you don't know what work is."

* * * *

A DANGEROUS PLACE

While showing an old lady over the *"Victory"* at Portsmouth, the marine indicated the brass plate marking the spot where Nelson fell.

"I don't wonder at it," she said. "I nearly slipped over on it myself."

* * * *

"Salubrious," said the American tourist, putting his head out of the train window.

"Exhilarating!" said his companion.

"Ye're baith wrang," remarked a fellow-traveller. It's Killiecrankie."

* * * *

Manager (to office boy): "Jones, whatever are you doing with your feet up on the desk?"

Jones: "Cutting down expenses sir; I haven't a rubber, so I'm using my rubber heel to save buying one."

* * * *

American: "Yes, my brother was killed by a revolving crane."

Englishman: "Goodness! what fierce birds you have in America."

* * * *

A holidaymaker went fishing on Slushsand pier and, having pulled out a good-sized plaice, threw it back again.

"Wot d'yer do that for?" asked a bystander.

"I don't want one that's been trod on."

Diving in Search of a Lost Anchor

By J. Ryan

I am a diver, and I feel sure that readers of the *"M.M."* will be interested in a typical piece of work I was once called upon to carry out. This was the recovery of a large mooring anchor from which the buoy had become detached.

When the boat carrying my equipment and assistants arrived above the presumed position of the anchor, the air supply pipes and the valves in the helmet of my diving suit were tested while the depth of the water was being taken. Then I was dressed in the standard diving suit. This is made of a rubber and canvas mixture, and covers the body completely up to the neck, except for the hands, which are thrust out through cuffs of pure red rubber that fit snugly over the wrist.

The corselet, a brass ring fitting over the shoulders, was next bolted on to the suit. Then my heavy boots were put on and the helmet was fitted, a quarter of a turn being sufficient to tighten this on the interrupted threads of the fitting by which the joint is made. The helmet has a detachable face glass, and on the back are attached the air-pipe, and the breast rope, which usually carries the telephone wire by means of which the diver communicates with the crew of the boat from which he descends. Air-pipe and breast-rope were caught up by clips on my belt, which also holds my knife; and finally front and back weights of 30 lb. each were fitted.

I was now burdened with a weight of about 200 lb., and under this load I staggered out of the boat on to a short ladder over the side. There the face glass of my helmet was screwed on, and I was informed that the depth was 16 fathoms, and that I could expect one stop when ascending. I slid on the shot rope, a stout rope weighted with a 56 lb. iron shot resting on the bottom, and shut off my outlet valve for a time to test the suit for leaks. Presently my attendant tapped my helmet to signify that no air bubbles were escaping. I then released air until I began to sink, and with a wave of my hand slid swiftly downward.

On reaching the sea floor I began my search for the anchor, Coiled up at the bottom of the shot rope was the stray line, a rope that serves as a necessary guide, for the diver's vision usually is obscured by clouds of mud. With the loose end of this in my hand I crawled out as far as its length of 30 ft. would allow me, and then began to circle round. Suddenly the line caught in some object, but on examination I found this to be an old tin trunk full of bottles! I resumed my circling, and after finding several other unwanted objects eventually located the anchor itself. I immediately signalled for a rope to be sent down to be attached to it.

When my task was finished I groped my way to the shot rope. There I received the signal to ascend, and closed the outlet valve until the suit ballooned out sufficiently to enable me to float upward. When I was still 10 ft. from the surface I was reminded by a signal of the "stop" already mentioned, and I had to remain at that level for five minutes. Stops are the most tedious part of diving. Their purpose is to prevent the ill effects that are liable to occur after working in compressed air in the diving suit, if the ascent is too rapid.

Water Supplies from Swiss Glaciers

By Donald R. Barr-Wells

In the South of Switzerland water for domestic and agricultural purposes is diverted from glaciers and brought down the mountain sides to the villages in artificial channels known as "bisses." A bisse is simply a narrow canal cut out in the rock or dug in the ground, according to the situation. The usual width is 2 ft. to 5 ft., the depth varies from 1 ft. to 3 ft., and the length may be from three to six miles. In places it has been necessary to cross deep chasms, and there hollow tree trunks are employed as aqueducts. Three or four men usually look after each bisse and keep it in repair, and a narrow footpath is made alongside to enable them to reach any point along its length. In certain places an ordinary footpath is impossible, and there iron rods have been driven into the rock and planks laid on them to form a gangway.



A precarious position on the footpath by the side of a "bisse" or waterway, on a Swiss Mountain. A bisse is a narrow channel in which water is brought from glaciers to the valleys below, and our photograph shows how one of these channels crosses a deep chasm.

A simple but ingenious system is employed to warn the guardian of a bisse of any interference with the flow of water. At the lower end of the waterway there is a hammer worked by a small water wheel. The hammer beats continuously on a wooden plank in the house in which the guardian lives, and where his tools are kept; and the noise stops when water ceases to flow.

The flow of water into the upper end of a bisse is controlled by a valve. At the lower end the current is divided into several small streams leading to artificial lakes, used as storage tanks; and from there the water is distributed to the points where it is required. From November to March these interesting waterways are covered with ice, and now most of them are being replaced as far as possible by underground concrete pipes.

The Origin of Locomotive Whistles

The locomotive whistle is such a familiar sound to-day that it is strange to remember that the earliest locomotives were not provided with these warning devices. On the first railways engine drivers had no means of giving warning of their approach other than by blowing a horn similar to those used on stage coaches. As the result of a collision at a level crossing on the Leicester and Swannington Railway, however, it was decided to experiment with a more efficient warning device, and a maker of musical instruments in Leicester was directed to design a "steam trumpet" to be worked off the engine boiler. This "trumpet" was duly made, and proved successful so that its use soon spread to other railways. The cup whistle, as commonly used to-day, is believed to have been the invention of a certain William Stephens, an employee of the Dowlais Iron Works, where it was in use in 1833.

The different tones of whistles in use are very numerous, for almost each pre-grouping company had a pattern of its own, apart from any "new notes" that have been introduced since grouping. On the whole, the whistles fitted to British locomotives are shrill in tone compared with those commonly used in America, where the whistle of the L.M.S.R. *"Royal Scot"* locomotive during its 1933 visit was described as a "pip-squeak." This term could hardly be applied to the whistles used on engines of the former Great Central and North Eastern Railways, however, which are deep and dignified in tone. On the other hand the G.N. type of whistle on the Gresley "Pacifics" is distinctly shrill. Although recent whistles on the North Eastern have been deep toned, there were exceptions in earlier days, for it is related that two small passenger engines once working in the neighbourhood of Harrogate were provided with the most ear-piercing and blood-curdling whistles that ever adorned a British locomotive! These whistles were said to be able to "wake every echo in the Nidderdale glens for miles."

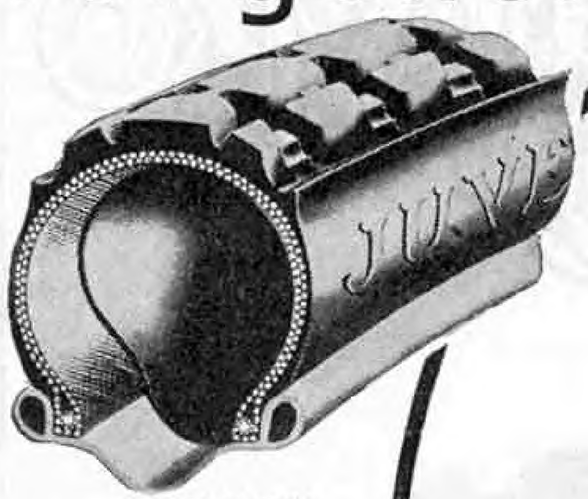
Present standard practice on the L.M.S.R. exhibits a return to the type of whistle used by the pre-group Caledonian Railway and still used on engines of St. Rollox design. Thus instead of a shrill bell whistle, the engines designed since the advent of Mr. W. A. Stanier, are provided with a hooter. The characteristic "toot" of these closely resembles the siren of a steamer.

An interesting variation of Caledonian practice was the fitting of a special type of hooter to an engine well-known for many years between Glasgow and Carlisle. This was the once-famous McIntosh 4–6–0 *"Cardean,"* now unfortunately scrapped, but the most powerful express engine in the country at the time of its construction in 1906. The hooter was truly a foghorn as regards its noise-producing properties, and enabled the engine to be identified anywhere. This instrument is said to have originated in the United States, but whether this was so or not, it is certain that its resounding tones thrilled many locomotive enthusiasts during its time.

A more up-to-date importation from the United States has been the adoption on the L.N.E.R., for the giant "Mikados" of the *"Cock O' the North"* series, of what is known as a chime-whistle. This gives a pleasing and melodious note, deep in tone.

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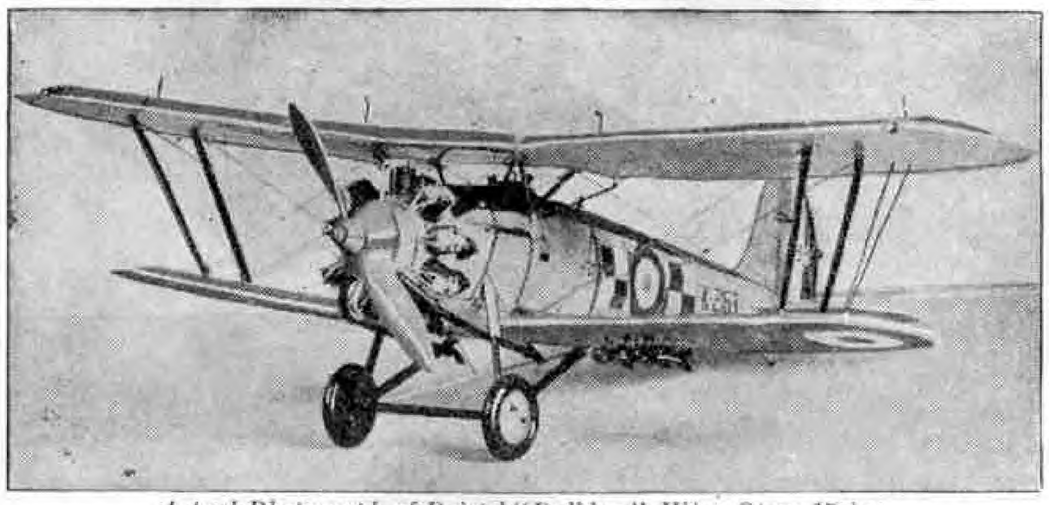
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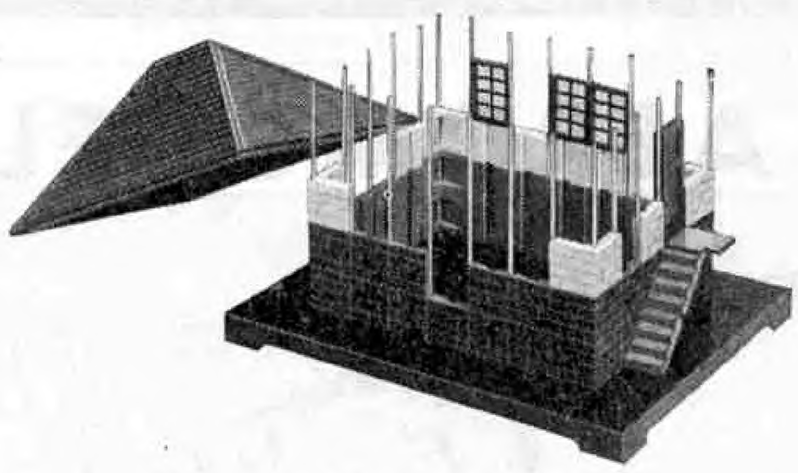
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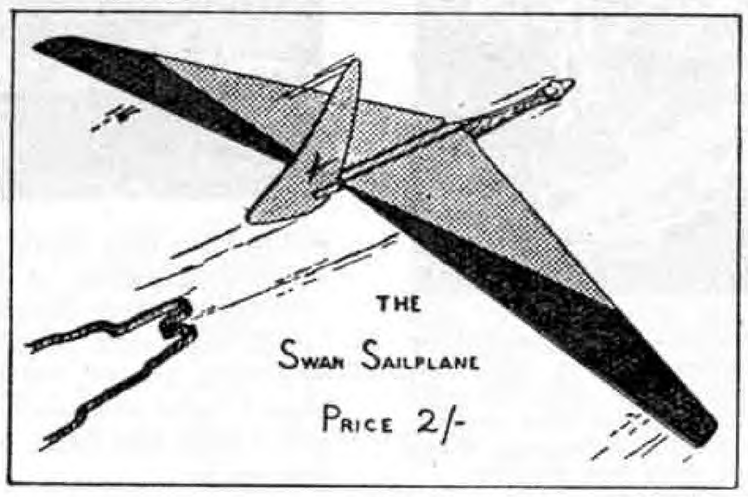
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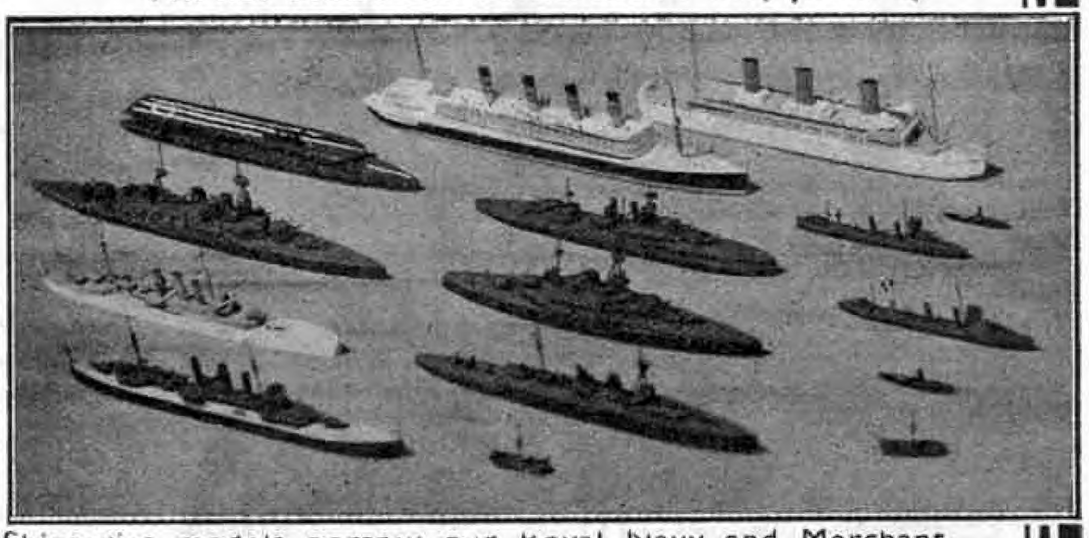
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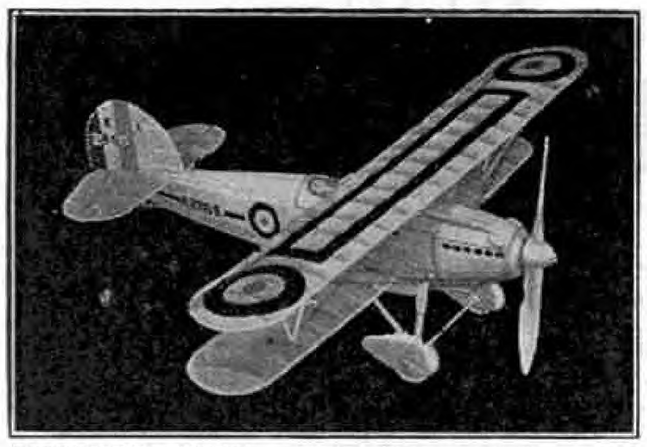
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For illustrated list and address of nearest agent write:

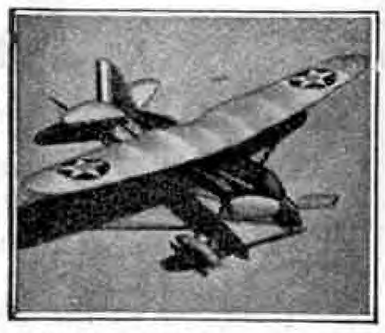
A. J. HOLLADAY & CO. LTD. (Desk B)

3, Aldermanbury Avenue, London, E.C.2

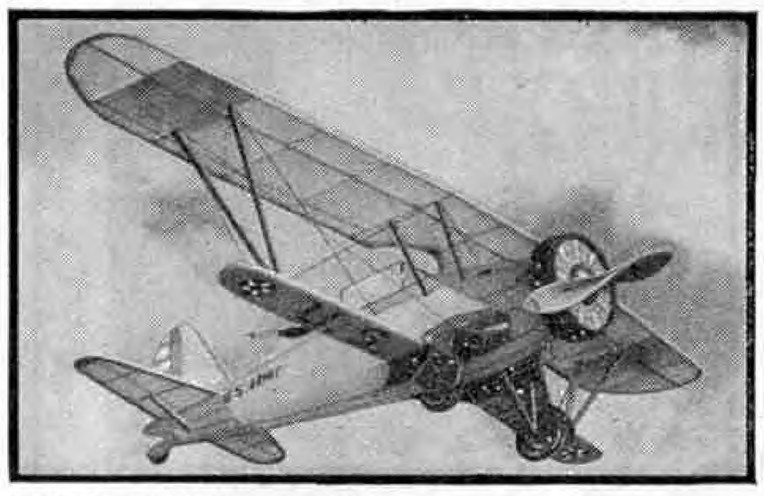
FLYING SCALE MODELS



HAWKER FURY. Wing span 19½ in. **6/6**
A real flying scale model of the Hawker Fury, Squadron No. 1. Comet's new revolutionary "Auto-line-up" method is the greatest advance of the year in building model planes; fuselages are no longer out of line, and building time is reduced. This model has a very detailed plan with explicit instructions—any model builder can tackle it with confidence. All controls movable. Very good flyer. The kit contains formers and ribs machine printed on balsa, all other balsa wood needed; double size tube of special quick drying cement; carved balsa prop; turned balsa wheels; and everything else you need. Wing span 19½ inches, length 17 inches. Complete kit post free for 6/6.



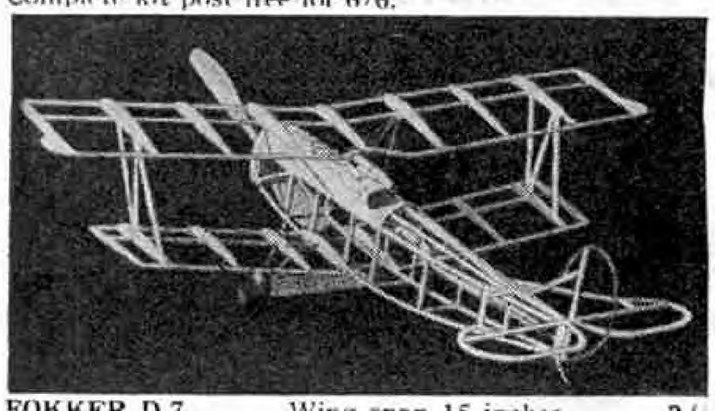
PAGE RACER. **1/9**
Very good flyer. The plan is very clear and the instructions are extra full. Kit includes shaped balsa prop, printed and strip balsa, cement and all else needed, 12½ inch wing span. Post free for 1/9.



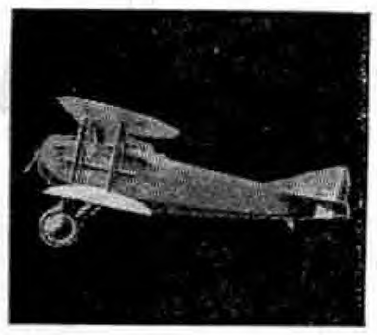
CURTISS RAVEN. Wing span 18¼ inches. **3/6**
Built on Comet's "Auto-line-up" method which ensures a true fuselage. Complete kit includes all balsa needed, carved prop, quick-drying cement, and detailed plan with full instructions. Post free for 3/6.



FOKKER D.8.
BRISTOL FIGHTER.
Above flying models have 12 inch wing span. Kit includes full-size plan, printed and strip balsa, cement, and simplified fibre prop. Any one kit post free for 1/3.



FOKKER D.7. Wing span 15 inches. **3/-**
This shows the skeleton frame-work of the Fokker D.7 before covering with Japanese tissue. The plan and instructions are very clear and detailed—any beginner could build it. Kit includes all balsa needed, special quick-drying cement, carved balsa prop. Wing span 15 inches. Complete kit post free for 3/-.



SPAD. Wing span 12½ in. **2/-**
A flying model of the Great War fighter. The plan is very clear with good instructions. The kit includes shaped balsa prop, and all else needed. Big value, post free for 2/-.

You can have no idea of the fascination of model plane building until you have tried one of these kits. The wings and fuselages, etc., are built up from different sizes of strip balsa right on top of the full size plan given in each kit. Pins are used to hold the strips in place until they have been cemented by the very special quick drying cement given, which dries firm in 30 seconds. When the framework has been assembled it is covered with Japanese tissue, which is shrunk taut with water or steam. If you want an exhibition model the tissue is then painted with dope to the correct colour scheme.

Send your Postal Order for a kit NOW. We guarantee to refund your money in full if you are not more than satisfied. (Foreign countries add 20%.) Nearest Railway Station MUST be given.

Send 1½d. stamp for our beautifully illustrated flying scale model airplane catalogue, eight pages showing 32 different models. Also Balsa wood and spare parts.

M. SWEETEN LTD.
Bank Hey Street, BLACKPOOL

Jolly fine fun - and instructional too !



LOTT'S BRICKS

How would you like to build this attractive house? And hosts of other models as well—Stations, Signal Boxes, Bridges, Goods Sheds. There is no end to the interesting things you can build. LOTT'S BRICKS are miniature Stone Building Bricks—British made.

Prices:
LOTT'S BRICKS, 2/- to 35/-
LODOMO *(with windows and doors)*, **3/6 to 12/6**
TUDOR BLOCKS *(for half timbered buildings)* **3/6 to 35/-**

LOTT'S Chemistry Sets



If you are keen on Chemistry, this set is the very thing for you! You will have your own laboratory and be able to carry out scores of interesting experiments. The equipment varies with the size of the set, and includes test tubes, crucibles, Bunsen burner, retort stand and many chemicals. Full instructions are supplied with each set.

Prices 3/6, 6/-, 10/6 to 42/-
Handsome Cabinets from £3/3/- to £5/5/-

Box 5, 228 experiments, 21/-

Obtainable at all leading toy dealers and stores. Send for free illustrated list of all Lott's products from Dept. M.M.

LOTT'S BRICKS LTD., WATFORD, HERTS., ENGLAND.



No license is necessary to use a B.S.A. Air Rifle in the house or garden, but the purchase must be made by someone over 17 years of age.

Boys!

There is no limit to the fun you can have with a

B.S.A Air Rifle

Prices from **45/-** or only **4/3** a month

You can practice accurate shooting on a target . . . . . or test your skill at a moving object such as a swinging tin.

You can try hitting a cane implanted firmly in the ground . . . . . sniping the stem off clay pipes and other difficult shooting feats.

When you become an expert marksman you can use your B.S.A. Air Rifle against rats and other pests in the garden.

B.S.A. Pellets .177" size, cost only 2/3 per 1,000—37 accurate shots for one penny.

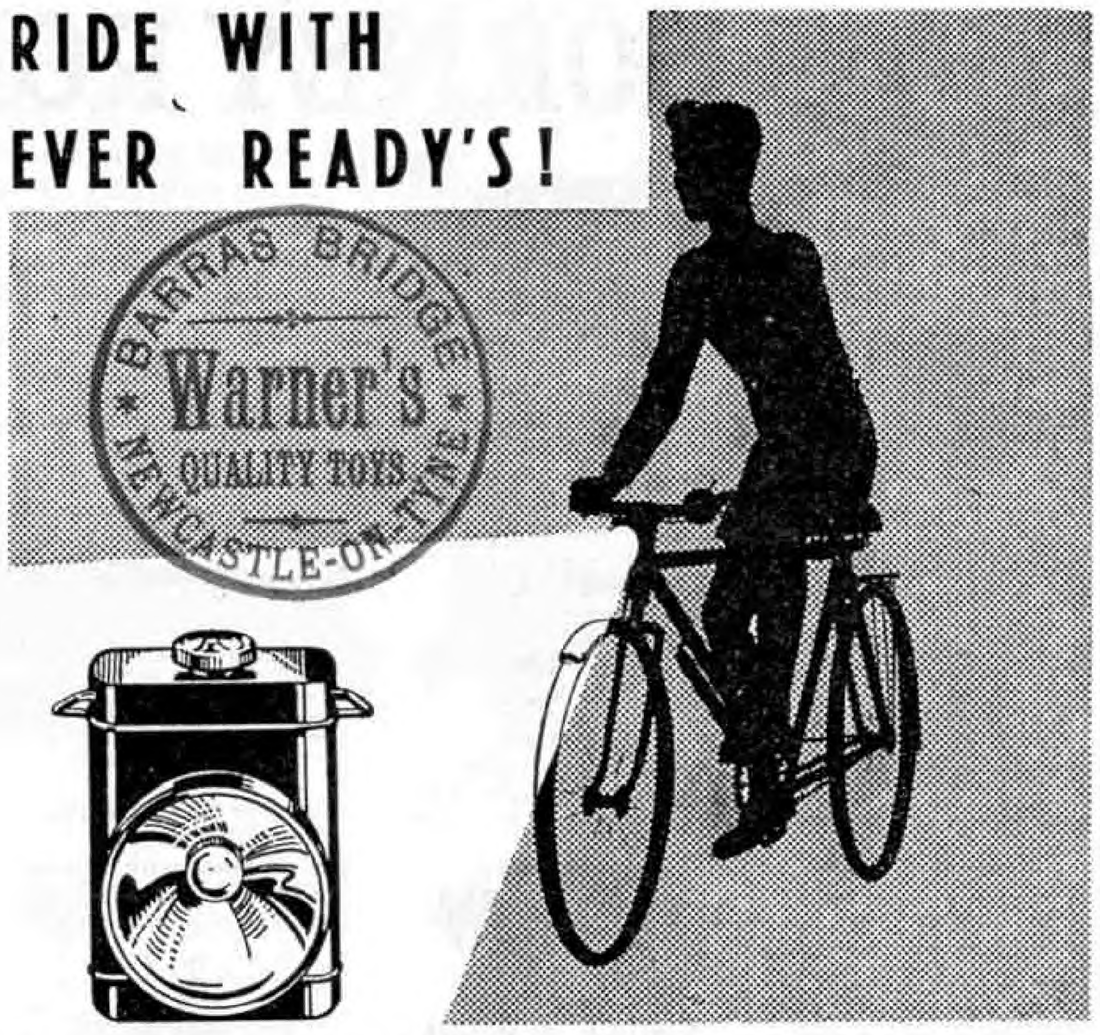
See B.S.A. Air Rifles at your dealer's. Meantime add your name and address to the coupon below and post to-day to B.S.A. Guns Ltd., 92, Armoury Road, Birmingham 11.

B.S.A. Guns Ltd., 92, Armoury Road, Birmingham 11
Send me the B.S.A. Air Rifle Leaflet.

Name .....

Address

RIDE WITH EVER READY'S!



You really need Ever Ready *electric* cycle lamps on your bike. They're smarter, more powerful too. Flick the switch and flash!—there's that beam streaking out ahead. And Ever Ready rear lamps mean you're *safe* because you're *seen*. No mess with Ever Ready's—no matches either.

EVER READY
Regd. Trade Mark

ELECTRIC CYCLE LAMPS

Electric Head-lamp Price 2/6. Electric Rear Lamp Price 1/6.

MADE BY THE EVER READY CO (GT. BRITAIN) LTD., HERCULES PLACE, LONDON, N.7

HORNBY
ACCESSORIES FITTED FOR ELECTRIC LIGHTING

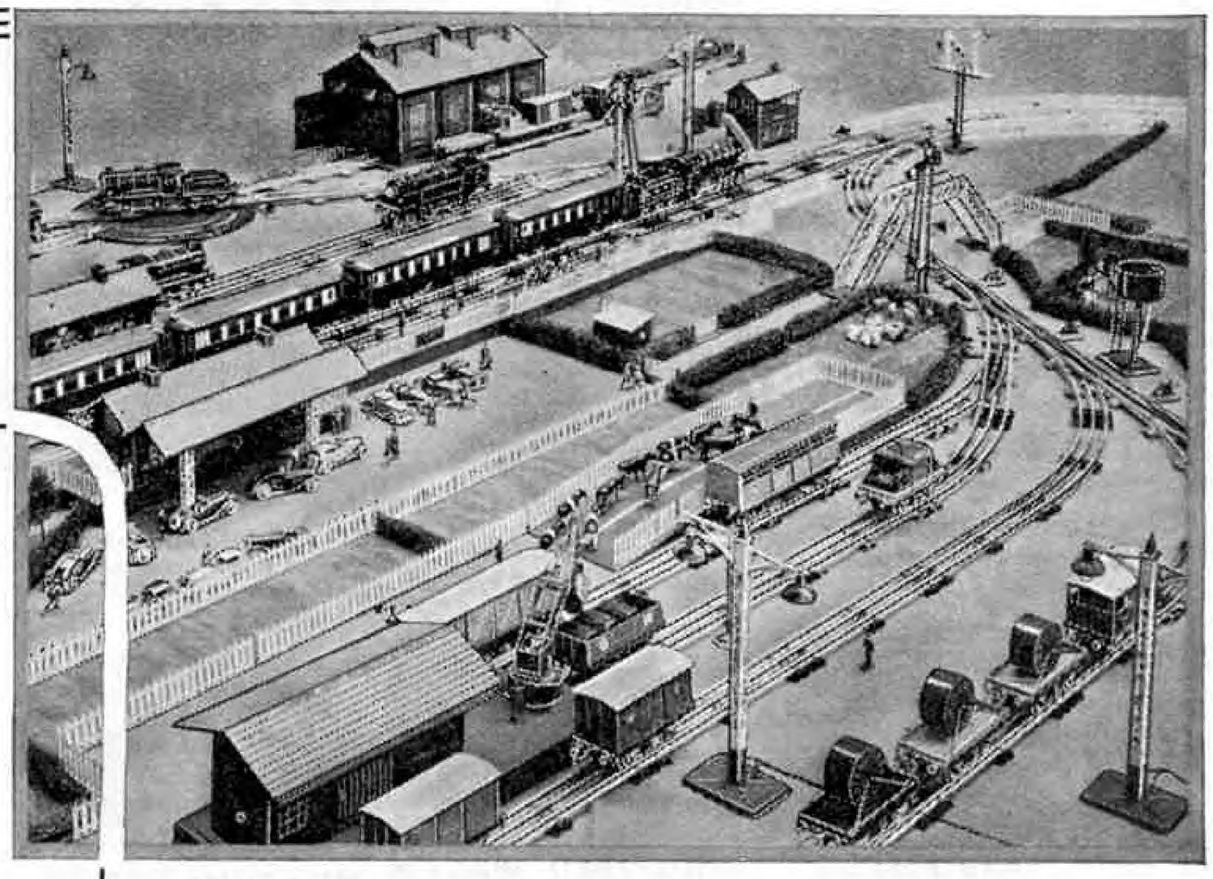
NEW SYSTEM

The following is a complete list of the Hornby Accessories available fitted for electric lighting on the new and simplified system adopted this season. These accessories are specially designed for lighting from the 3½-volt circuit of a Meccano T20A or T6A Transformer, and with each of these Transformers are packed for the purpose a pair of Plugs, an Earthing Clip and a coil of Wire, together with full instructions. The Accessories can also be lighted from an accumulator. Each Accessory is accompanied by an Earthing Clip and Leaflet giving full instructions for use. Lamp bulbs are not provided with the Accessories.

	Price		Price
No. E1E Engine Shed	15/6	No. 2E Signal Gantry	12/9
No. E2E Engine Shed	23/–	No. E1E Level Crossing ...	5/3
No. 2E Station	9/3	No. E2E Level Crossing ...	9/–
Island Platform E	6/3	No. 1E Buffer Stops	1/6
No. 2E Goods Platform	11/6	No. 2E Buffer Stops	6/–
No. 2E Signal Cabin	4/3	No. 2E Water Tank	6/6
No. 2E Signal	2/9	No. 1E Lamp Standard	2/11
No. 2E Double Arm Signal ...	3/11	No. 2E Lamp Standard	3/3
No. 2E Junction Signal	6/–		

The following items used in connection with the new system of Accessories lighting are available:

Plugs for sockets of Transformers T20A and T6A ... ... Price per pair 6d.
Earthing Clips ... ... each 3d. Connecting Wire Price per coil 4d.



ACCESSORIES FOR LIGHTING WITH DISTRIBUTION BOX AND FLEXIBLE LEADS

The old type Accessories fitted for lighting by means of a Distribution Box and Flexible Leads with plugs and sockets are still available at the following prices:

	Price		Price
No. E1E Engine Shed ...	18/6	No. 2E Signal Gantry ...	18/–
No. E2E Engine Shed ...	26/–	No. E1E Level Crossing ...	7/–
No. 2E Station	11/6	No. E2E Level Crossing ...	11/–
Island Platform E	9/–	No. 1E Buffer Stops	2/–
No. 2E Goods Platform ...	15/–	No. 2E Buffer Stops	7/–
No. 2E Signal Cabin	5/6	No. 2E Water Tank	10/–
No. 2E Signal	4/3	No. 1E Lamp Standard ...	3/6
No. 2E Double Arm Signal ...	6/6	No. 2E Lamp Standard ...	4/3
No. 2E Junction Signal ...	9/–		

Flexible Leads, 9", 18", and 36". Prices 1/4, 1/5 and 1/6 respectively.
Distribution Box ... ... Price 2/6

MECCANO LTD., BINNS ROAD, LIVERPOOL 13

HORNBY ROLLING STOCK

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines, strongly built and beautifully finished.

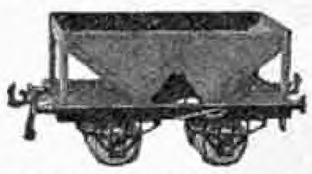
Ask your dealer to show you the full range of Hornby Rolling Stock.



No. 1 PETROL TANK WAGON "PRATTS"
Finished in buff. Price 2/–



BRAKE VAN (French Type)
Lettered "NORD," Beautifully finished in colours. Opening doors. Price 4/–



***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price 3/6



JACOB'S BISCUIT VAN
Finished in brown, with opening doors. Price 2/9



***FLAT TRUCK**
Without Cable Drum. Price 1/6
Complete with Cable Drum ... Price 1/9

CABLE DRUM
(British Insulated Cables Ltd.) ... Price 3d.

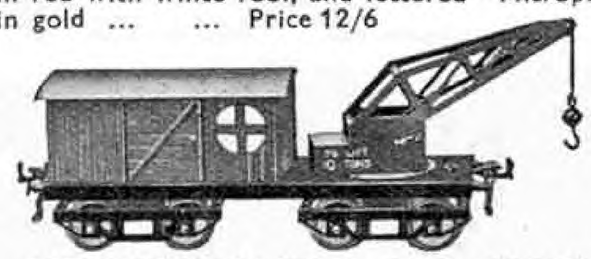


No. 1 TIMBER WAGON
Beautifully finished. Price 1/6

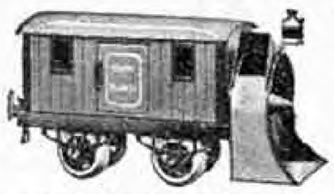


RIVIERA "BLUE" COACH
"Dining" or "Sleeping"
This is a beautiful model, substantially built and well finished. Suitable for 2 ft. radius rails only. Price 12/6

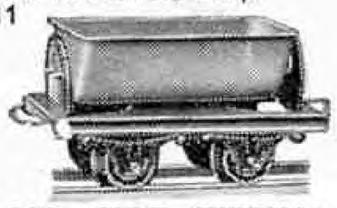
No. 3 Continental "MITROPA" COACH
Similar in design to the above. Beautifully finished in red with white roof, and lettered "Mitropa" in gold ... ... Price 12/6



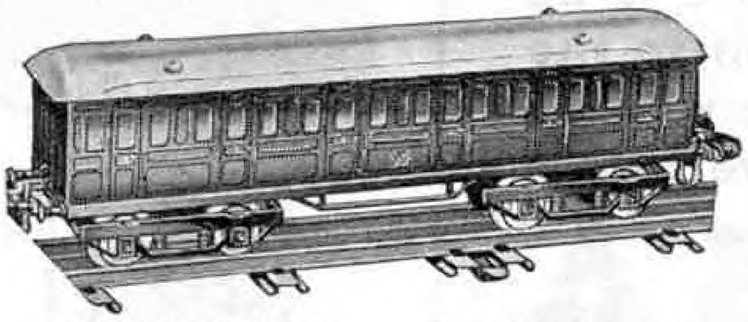
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in green and blue, with opening doors. Suitable for 2 ft. radius rails only. Price 5/11



SNOW PLOUGH
With revolving plough. Price 3/9

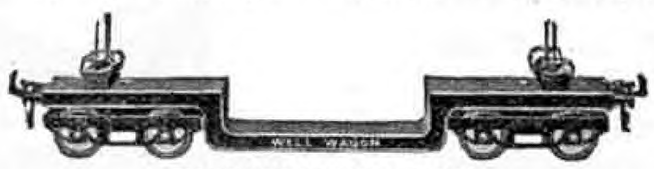


MO SIDE TIPPING WAGON
Finished in bright yellow, tips either side. Price 1/-

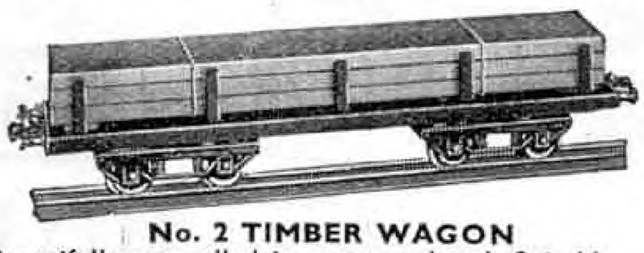


METROPOLITAN COACH, C
As supplied with Metropolitan Clockwork Train Set ... ... Price 7/6

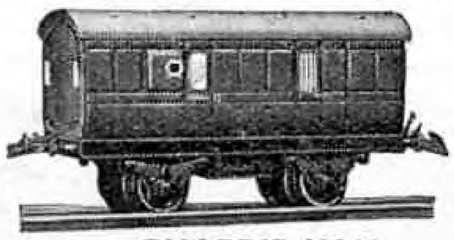
METROPOLITAN COACH, E
As supplied with E36 Metropolitan Electric Train Set ... Price 11/6



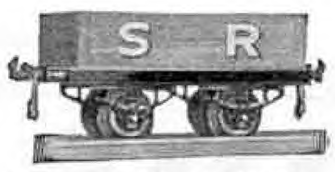
TROLLEY WAGON
Finished in red and green. Suitable for 2 ft. radius rails only ... ... Price 3/11



No. 2 TIMBER WAGON
Beautifully enamelled in green and red. Suitable for 2 ft. radius rails only ... ... Price 2/6



GUARD'S VAN
In colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Price 2/6



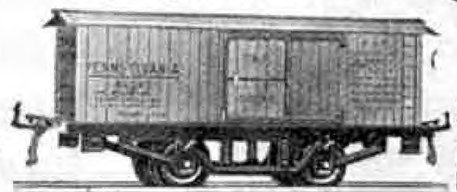
***No. O HORNBY WAGON** Price 1/6
No. 1 HORNBY WAGON (illustrated) Price 1/9



TANK CAR, American Type
Model of the type of oil tank car used in America ... Price 1/9



CARR'S BISCUIT VAN
Finished in blue, with opening doors. Price 2/9



BOX CAR, American Type
This is a model of the type in use on American railways. Price 2/6

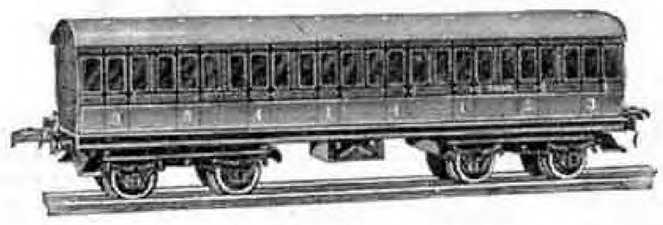


***No. 1 LUGGAGE VAN**
With opening doors. Price 2/9

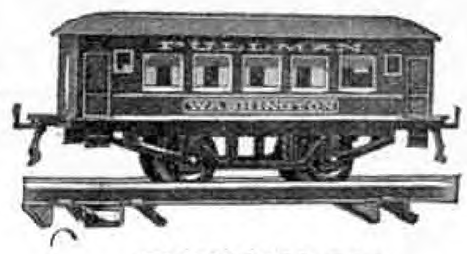


MO PETROL TANK WAGON "Shell Mex"
Finished in cream with lettering in black. Price 1/–

TARPAULIN SHEETS
Lettered L.M.S., G.W., N.E. or S.R. For fitting to Hornby Wagons. Price 2d.



***No. 2 PASSENGER COACH**
Suitable for 2 ft. radius rails only. First-third, or Brake-third. ... ... Price 7/6



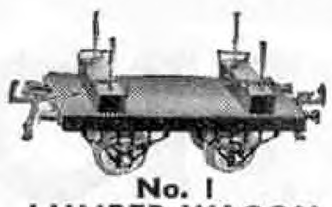
PULLMAN CAR
Imported from U.S.A. Product of Meccano factories.

American Type (as illustrated). Yellow or green, with orange or bright red roof. Lettered "Washington" or "Madison" ... Price 1/6

Continental Type. No. O. Red with white roof. Letered "Mitropa." Price 1/6



BRAKE VAN
Finished in brown, with opening doors. Obtainable with N.E. or S.R. lettering. Price 2/11



No. 1 LUMBER WAGON
Fitted with bolsters and stanchions. Price 1/6



***No. 2 LUGGAGE VAN**
Fitted with double doors. Suitable for 2 ft. radius rails only. Price 4/6



***No. 2 CATTLE TRUCK**
Fitted with double doors. Suitable for 2 ft. radius rails only ... Price 4/6



CABOOSE, AMERICAN TYPE
Modelled on the type of brake van used on American railways. Price 2/6



COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. Lettered "NORD" ... Price 2/6



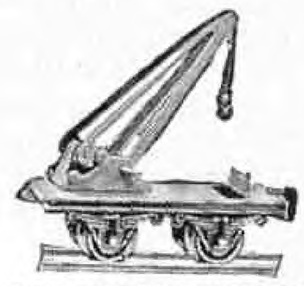
MILK TANK WAGON "UNITED DAIRIES"
Finished in blue and white. ... Price 4/6



CEMENT WAGON
The door at the top opens. Finished in bright red ... Price 2/6



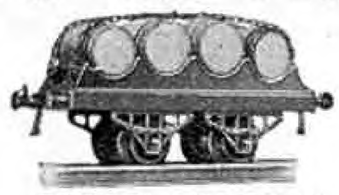
CHOCOLATE VAN "CADBURY'S"
Beautifully finished in blue with white roof. Price 2/9



MO CRANE TRUCK
Finished in blue. Crane revolves on its base. Price 1/–



BITUMEN TANK WAGON "COLAS"
Finished in blue Price 3/6



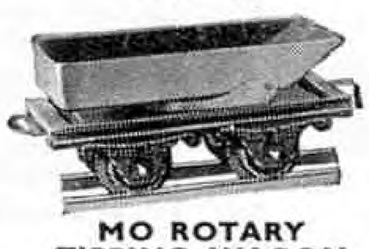
BARREL WAGON
This is a model of a type of wagon used in France and other European countries ... Price 2/6



No. O BANANA VAN
Finished in grey. Lettered L.M.S. only ... Price 1/9



WINE WAGON DOUBLE BARREL
This model represents the French double-barrel type of Wine Wagon Beautiful finish. Price 4/6



MO ROTARY TIPPING WAGON
Finished in green. Container revolves and tips at any angle ... Price 1/–



No. 1 ROTARY TIPPING WAGON
Finished in blue and pale gold ... ... Price 2/6

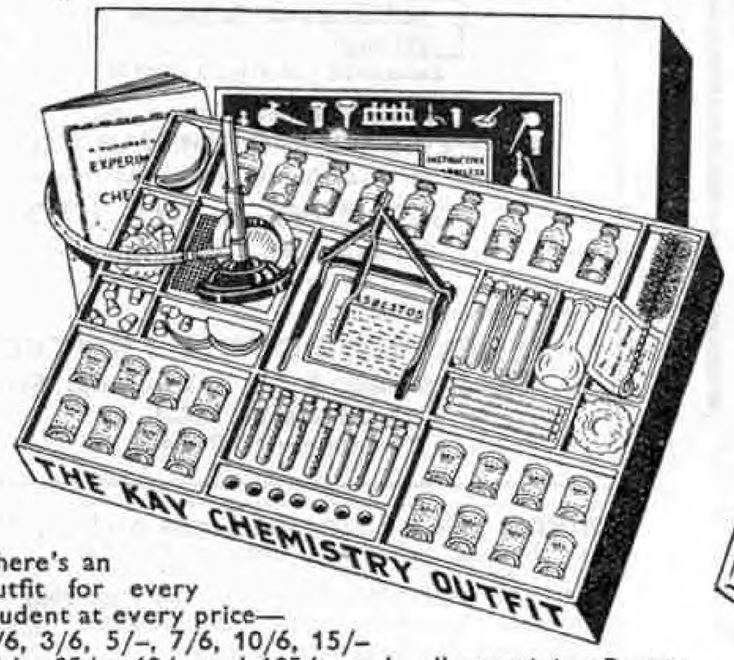
In L.M.S.R., L.N.E.R., G.W.R., or S.R. lettering.

MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

FOR THE BOY WHO WILL HAVE THE BEST—

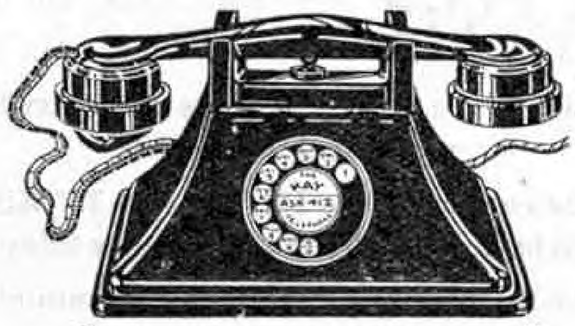
KAY

Real laboratories containing all the apparatus and chemicals to perform hundreds of fascinating yet harmless experiments. Each outfit is complete in itself—the pride and joy of every lucky owner.



There's an outfit for every student at every price—
2/6, 3/6, 5/–, 7/6, 10/6, 15/–
21/–, 35/–, 63/– and 105/– each, all containing Bunsen Burners, an excellent assortment of chemicals and apparatus, and full instructions. The set illustrated is 10/6.

KAY



A pair of REAL HOUSE TELEPHONES; Full-sized, one-piece instruments; Automatic calling; Perfect reception; working off ordinary pocket-lamp batteries.
These wonderful Telephones are absolutely fool-proof and are very simple to instal. They are ideal for: The Home; The Office; The Workshop.
Complete with 2 instruments, 30 ft. of twin wire and full instructions, 25/– set.
There is also a cheaper model at 15/6 set.

KAY

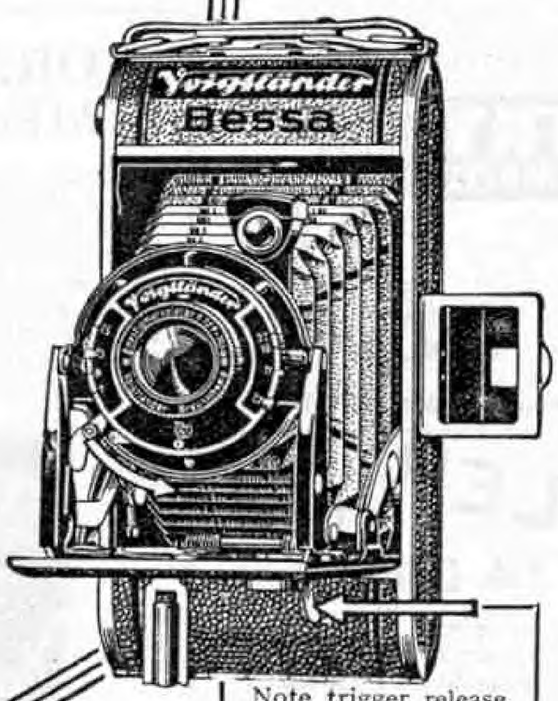
Complete electrical workshops providing many hours of interest and amusement. There is no difficult construction, all the various parts being complete electrical units in perfect working order.



Complete outfits are sold at all prices—2/–, 3/6, 5/6, 7/6, 10/6, 12/6, 15/–, 21/–, 30/– and 50/– each, the larger ones including Electric Bells, Motors, Induction Coils, Dynamotors, Tapper Sets, Telephones, etc. The set illustrated is 10/6.

Obtainable from all leading Stores, Toyshops and Sports Shops. If you have any difficulty, please send direct to the manufacturers:
KAY (Sports and Games) LTD. Dept. M.M. CARLISLE ROAD THE HYDE LONDON, N.W.9.
Send for FREE Illustrated Catalogue.

THIS camera takes TWO sizes of pictures at the best position— EYE LEVEL

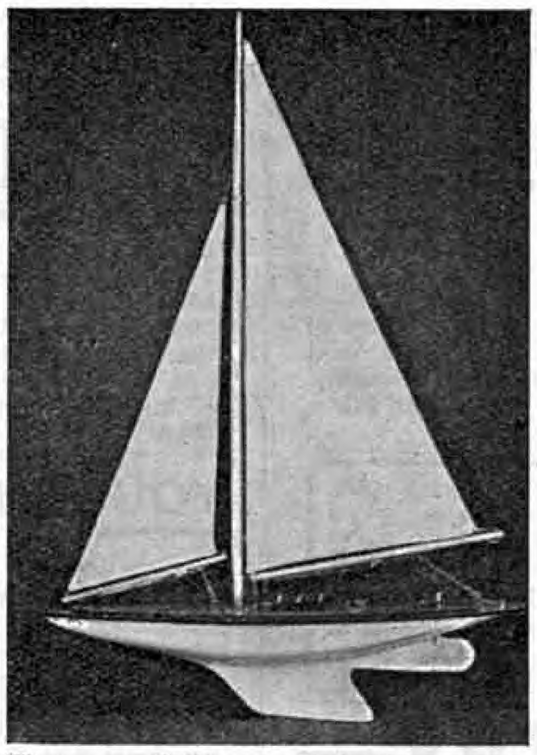


Note trigger release fitted under baseboard, enabling camera to be held rock-steady in both hands at eye-level.

Voigtlander BESSA

With F/7.7 Voigtlander Voigtar Anastigmat lens in speeded shutter **52/6.**
Other models from **£3/12/6** to **£9/8/–.**
Write for the Bessa brochure to
SCHERING LTD.
(Voigtlander Dept. J)
188/192, **High Holborn** W.C.1

Easy to open and close, the Voigtlander Bessa is held in BOTH hands and takes snaps as you *see* them—at eye level. With a standard 8 ex. $2\frac{1}{4}$ x $3\frac{1}{4}$ film you can take 16 half-size pictures if you prefer. The Bessa is the most original and competent camera ever sold at the price! See it at your dealers now.



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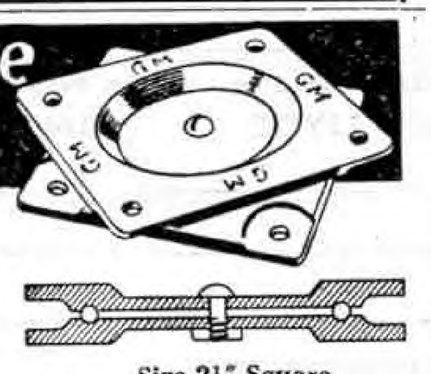
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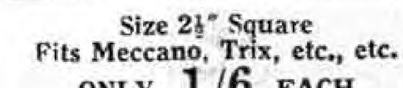
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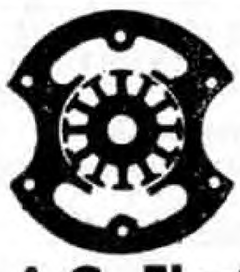
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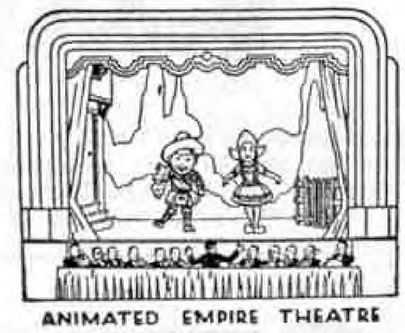
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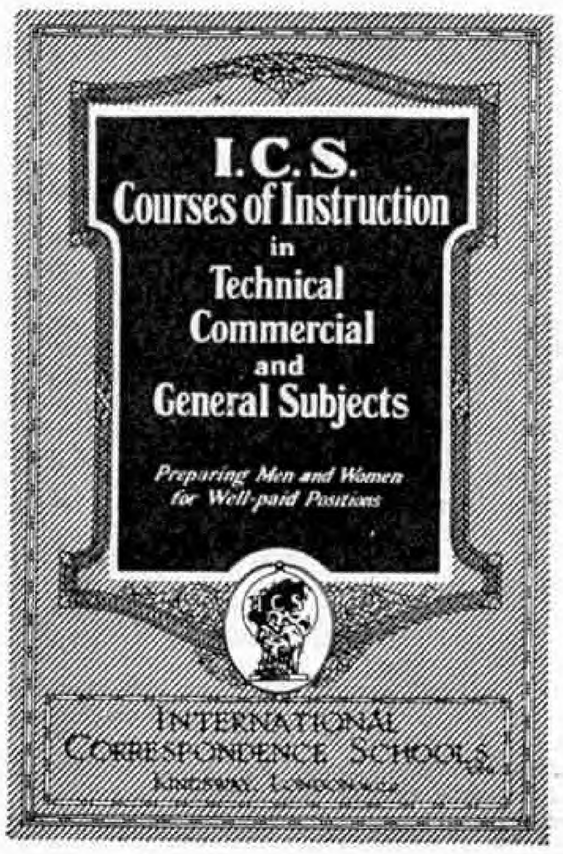
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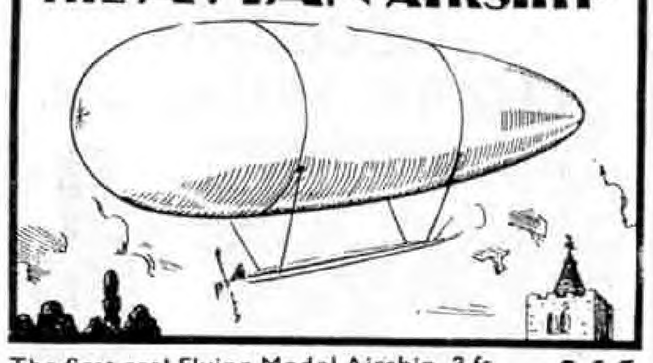
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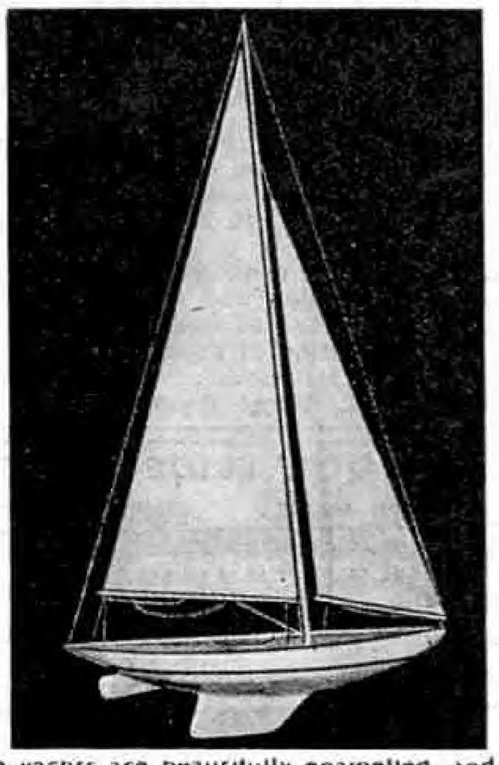
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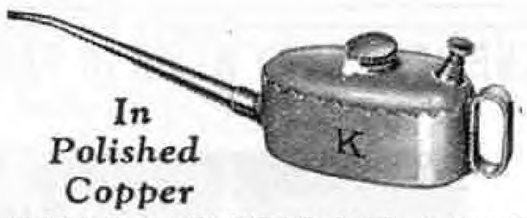
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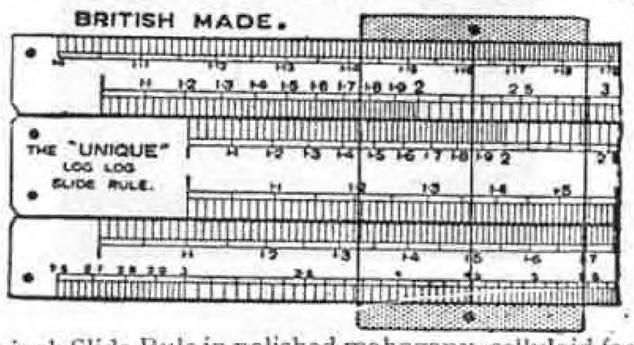
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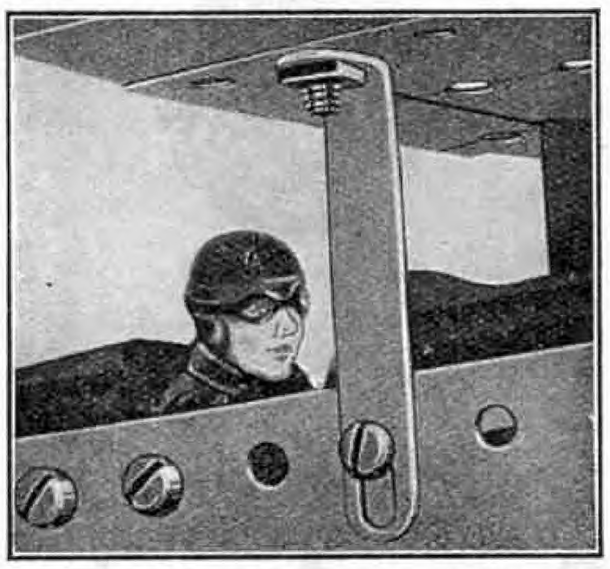


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Telegrams: "Meccano, Liverpool."

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The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

MECCANO ENAMEL



Meccano enamel has been introduced to enable model-builders to convert nickel parts to colour or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red or green, each colour being identical in shade with the enamels used in the Meccano Factory for spraying Meccano parts.

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TOYS OF QUALITY MADE BY MECCANO LTD.

DINKY BUILDER

A FASCINATING BUILDING HOBBY FOR GIRLS AND BOYS

This is one of the most fascinating building systems ever devised for young children to play with. The beautiful enamelled parts enable boys or girls to build very real looking Coaches, Aeroplane Hangars, Garages, Towers, Bridges, Wheel Toys, Windmills—hundreds of toys, each one a real strong plaything.

Meccano Dinky Builder Plates are hinged on all sides, with intervening spaces so that when two are placed side by side the hinged part of one Plate fits into the corresponding space in the other. There are now three Outfits in the series, each of which is supplied in two colour combinations, bright red and green, and salmon pink and light green.

MECCANO LTD., Binns Road, LIVERPOOL 13



No. 1 Dinky Builder Outfit.

No. O DINKY BUILDER OUTFIT

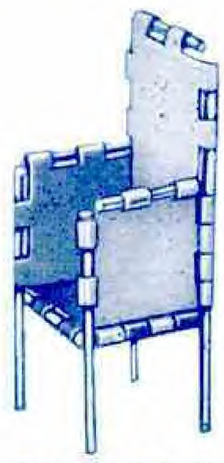
This is an excellent Outfit, containing a good assortment of Dinky Builder parts (including two road wheels), with which a splendid range of models can be built. The Instruction Folder included gives examples of 40 models, but many others of an original character can be constructed by the inventive boy or girl. Price 2/6

No. 1 DINKY BUILDER OUTFIT

This splendid Outfit contains a varied selection of parts, including two trees on die-cast stands that lend the correct atmosphere to models of farm buildings, churches, etc. A further attraction is a set of four road wheels for constructing miniature wheel toys, many examples of which are illustrated in the Instruction Folder. These instructions show a total of 70 fine models that any boy or girl can build. Price 4/11



Motor Van built with No. 1 Outfit.



Arm Chair built with No. O Outfit.



Garage built with No. 1 Outfit.



Porter's Truck Built with No. 0 Outfit.





No. 2 Dinky Builder Outfit

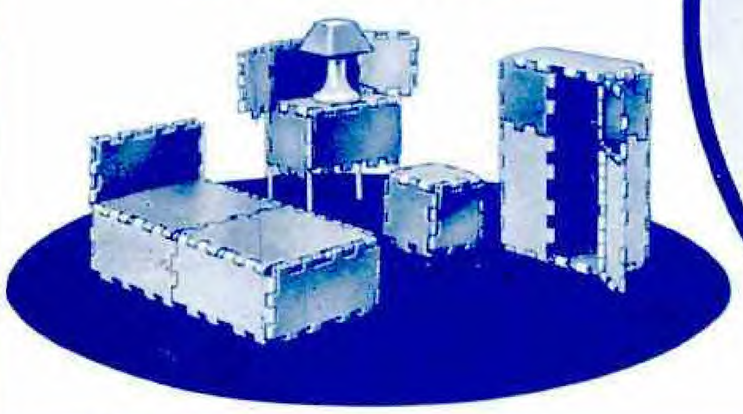
No. 2 DINKY BUILDER OUTFIT

The No. 2 Dinky Builder Outfit is the largest Outfit in the series. It contains a comprehensive selection of parts with which all the No. O and No. 1 Outfits models can be built. In addition, the parts in this fine Outfit make possible the construction of seven groups of miniature model furniture. The small table lamp and shade that are also included add greatly to the realism of these groups. Full instructions for building the complete range of models are given in the Instruction Folders included in the Outfit. Price 7/11

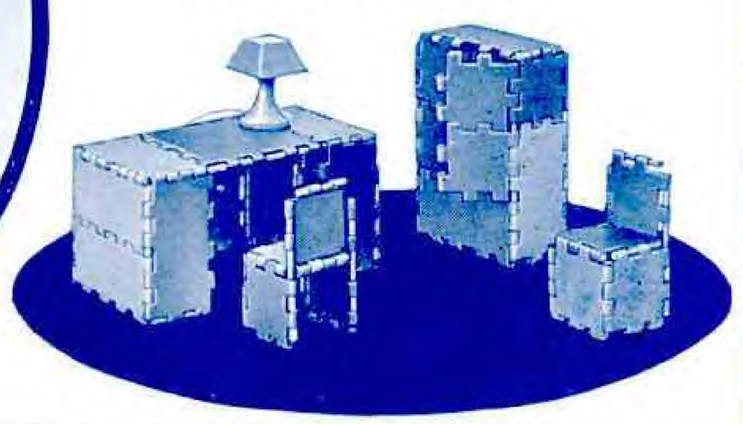
DINKY BUILDER "A"

The Dinky Builder "A" packet contains a useful assortment of Dinky Builder Parts for supplementing Nos. O, 1 and 2 Outfits. Price 1/-

Group of Bedroom Furniture made with No. 2 Outfit.



Group of Office Furniture made with No. 2 Outfit.



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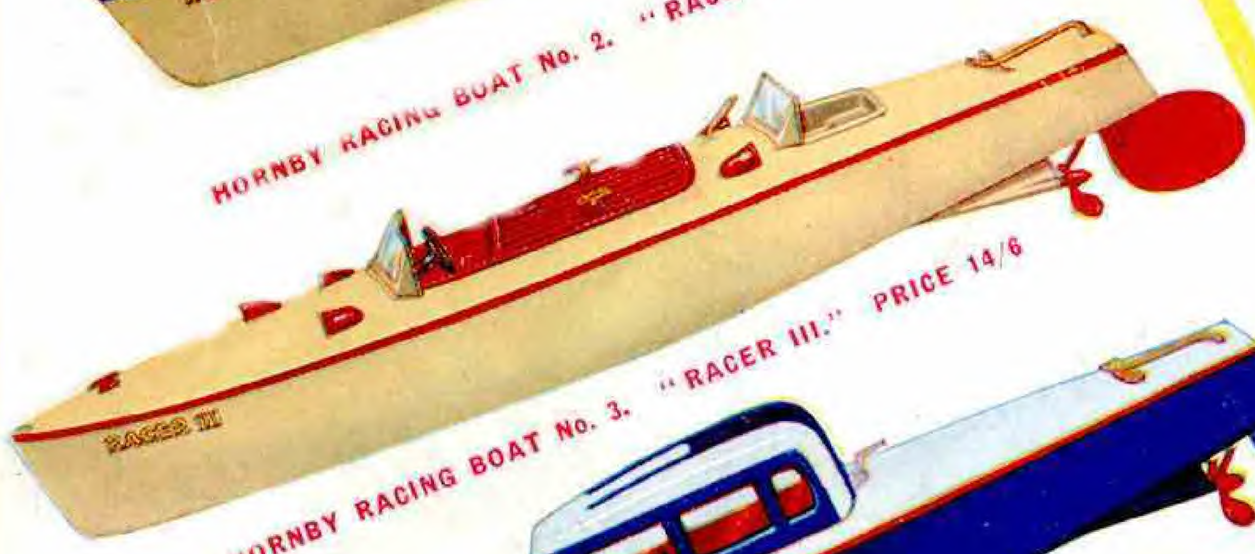
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HORNBY RACING BOAT No. 2. "RACER II." PRICE 8/6



HORNBY RACING BOAT No. 3. "RACER III." PRICE 14/6



HORNBY LIMOUSINE BOAT No. 4. "VENTURE." PRICE 15/6

HORNBY CABIN CRUISER No. 5. "VIKING." PRICE 16/6

Price List

HORNBY SPEED BOATS

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HORNBY LIMOUSINE BOAT No. 4. "VENTURE." Price **15/6**. Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

HORNBY CABIN CRUISER No. 5. "VIKING." Price **16/6**. Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

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